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MANCHESTER MEDICAL SOCIETY

A MANUAL
OF
MINOR SURGERY
AND
BANDAGING

*FOR THE USE OF HOUSE-SURGEONS, DRESSERS
AND JUNIOR PRACTITIONERS*

BY

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OF ENGLAND

ELEVENTH EDITION

LONDON
J. & A. CHURCHILL
7 GREAT MARLBOROUGH STREET
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PREFACE

In preparing an eleventh edition of this little book, which has now had an existence of over thirty-five years, I have availed myself of many useful suggestions by my late house-surgeons, Messrs. Ballance, Hunt, Rodocanachi and Russell, to whom my best thanks are due. Dr. Dudley Buxton has again kindly revised the chapter on Anæsthetics.

CHRISTOPHER HEATH.

36 Cavendish Square :
September 1897.

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MINOR SURGERY AND BANDAGING

FOR

HOUSE-SURGEONS

&c.

INTRODUCTION

The office of House-Surgeon to a public hospital is one of the most responsible posts a young surgeon can occupy, and, at the same time, its value in giving him both experience and confidence can scarcely be too highly estimated. Before, however, entering upon the more purely surgical duties of the house-surgeon, it may be well to say a few words on his relation to the other officials of the establishment, to the patients, and to the public.

Being resident, the House-Surgeon has the entire charge of all the surgical in-patients during the absence of the principal medical officers, and under his care also come all the casualties which may occur between the regular visits. This rule is modified in some hospitals by the fact that the Dressers are held responsible for the welfare of both in-patients and casualties, the house-surgeon occupying merely the post of a supervisor, who can be appealed to in the event of any special emergency; but, for brevity's sake, in the following pages the term House-Surgeon is employed to signify the responsible and acting officer.

It is obvious that the above arrangement must modify materially the relative positions of house-surgeon and dresser; in the one case the dresser being entirely subordinate, while in the other he acts in a great degree on his own responsibility. It is not within the scope of this work, however, to enter into these *minutiæ*, which are sufficiently regulated by the traditions prevalent in each institution.

The relation of the house-surgeon to the VISITING-SURGEON varies also in different institutions, and with different individuals. Some visiting-surgeons wish to do everything themselves, and are very wroth if a house-surgeon has opened an abscess or tightened a bandage; while others allow their subordinates considerable liberty, provided the patients suffer no harm. Here, again, tradition and observation during student-life will enable the house-surgeon to keep clear of all collision with his superior officers; and he is certainly bound to respect the reasonable prejudices of each surgeon with regard to the details of his practice, and not to attempt to bring the practices of two or three surgeons to one uniform level, by which all possibility of comparison would be lost.

It is most important, both for his own comfort and for the welfare of the patients, that the house-surgeon should keep on good terms with the non-medical portion of the establishment, ordinarily represented by a SECRETARY and a MATRON. These latter officers being permanent, and often of long standing, have frequently considerable power with the committee and governors at large, and have unfortunately also occasionally very strong views with respect to the manner in which the house-surgeon's duties are to be conducted; and it is sometimes difficult to venture in the least degree from the beaten track, even in a good direction, without offending their prejudices. A gentlemanly bearing and the exercise of proper tact will, however, often enable a house-surgeon to overcome difficulties at first sight insuperable; and it will generally be found, that when a house-surgeon has got into 'hot water' with the officials, it has been owing to some false step or want of courtesy on his own part. Should the house-surgeon find that he is interfered with in the proper discharge of his duties by any one, he is bound to state the facts to the superior medical officers, that the matter may be at once investigated and set right; for if any encroachment be permitted, the next occupant of the office may be still more harassed in the proper fulfilment of his charge.

It is to be hoped that the house-surgeon will never interfere with the duties of the CHAPLAIN, seeing that the spiritual care of the sick is not within the house-surgeon's province; the only difficulty at all likely to arise in this quarter is the tendency of some chaplains to prolong their visits to the wards, to the inconvenience of the dressers and others; but this can be easily remedied by a proper representation of the fact. The house-surgeon is bound to respect the privacy of a ward when prayers are being read, except in the case of accident or sudden emergency, when everything must yield to the necessities of the case.

Since most hospitals have medical schools attached to them, the house-surgeon may be of the greatest possible service to the STUDENTS, by encouraging their visits to the wards, and by taking the trouble to give a little clinical instruction in making his rounds. This will prepare him also for more formal clinical teaching, should he ever occupy the position of surgeon to a hospital; and since to teach is to learn, he can have no better way of improving himself in the practice of his profession. It would be well also if the house-surgeon would bear in mind the necessity for clinical observation, and take care that, when possible, the students should be summoned to witness any operation or remarkable accident which may occur at other than the regular hour of the surgeon's visit. With this view, also, the house-surgeon might possibly be self-denying enough not to reduce all dislocations, &c., *instanter*, when an hour's delay would not be of the smallest consequence to the patient, and would allow the students to see an accident such as they may be soon called upon to attend in private, and to witness its appropriate treatment at the hands of the visiting-surgeon. The house-surgeon must of course guard his patients against the meddling of inexperienced students, and have due regard also to the comfort and privacy of the wards, especially those occupied by female patients.

As the well-doing of the patient depends in no inconsiderable degree upon the good understanding between the house-surgeon and the NURSES, its maintenance should always be aimed at. Nurses often have views of their own with regard to the treatment of cases, which, if kept within proper bounds, may be of considerable service; for the inexperienced house-surgeon may not unfrequently gain useful hints from an intelligent woman who has been for years in the wards of a hospital; he must be careful, therefore, not to disgust his subordinates, in the first blush of office, by any sweeping revolutions or startling novelties. By an invariably courteous, and at the same time firm, behaviour, the house-surgeon will soon gain the confidence of nurses, who would perhaps prove insubordinate to a vacillating and rude officer, of even greater professional abilities. Two difficulties which have to be guarded against with respect to the nurses are, the tendency they have (in order to save trouble) to do all the dressings themselves instead of leaving them for the proper dressers, and the exhibition of favouritism to certain patients. To obviate the former, the dresser must be careful to attend in proper time, so that the general business of the ward is not delayed; and the latter must be judiciously checked, or, if necessary, may be prevented by transferring the patient to another ward. It can hardly be necessary to deprecate in the strongest terms any undue familiarity between the house-surgeon and the nurses or female patients, which no one who has any proper sense of honour would allow himself to indulge in for a moment.

The In-patients are in most hospitals admitted under the surgeon of the week or day on which they may happen to apply, but invariably any case sent specially to any individual surgeon is admitted under his particular care, and the house-surgeon should be careful to attend to this, as any infringement of the rule generally creates some ill-feeling. The division of the beds among the several surgeons will vary in different institutions, and there is generally an understood 'give and take' arrangement which obviates all overcrowding.

Unless evidently perfectly clean, or unless the severity of the injury or disease prevent it, all in-patients should have a warm bath before being put into bed, and even when the bath is not available, as much dirt as can should be removed by the nurse with soap and water. Except in the case of some sudden emergency, a patient should never be put into a bed lately occupied by another without the linen having been changed, and, if at all soiled, the blankets also. (In all hospitals the rule is that when a death has occurred the whole of the bedding should be changed.) The allowance of clean linen to each bed varies very considerably in different institutions, and a change will be required much more frequently in some cases than in others; but where the allowance is small, a neat appearance can be given to the beds by always placing a clean sheet first atop of the patient, and after a day or two shifting it to underneath him, and replacing it by another clean one, and so on. The house-surgeon should not consider the details of the bed of a patient as *infra dig.*, since his progress may materially depend upon his comfort in it. It will often make all the difference between a good and a sleepless night to a weary patient, if all crumbs, &c., are carefully swept out of the bed, and the sheets are thoroughly smoothed and tucked in on each side.

With regard to DIET the house-surgeon has more liberty in some hospitals than in others, but should always endeavour to avoid extravagance, and particularly the continuance of large quantities of stimulants or *extras* after the necessity for their administration is past. A table of the diet-rolls of some of the metropolitan hospitals will be found at the end of this book. Some little skill will be necessary in order to suit the capricious appetite of a failing patient, and there is ordinarily no difficulty in obtaining special niceties for such cases, on making a representation of the facts to the matron or steward.

In the matter of MEDICINE the house-surgeon should, as a rule, not commence a course of treatment without the sanction of the visiting-surgeon, and, should he be obliged to make any alteration in the surgeon's absence, must be careful to inform him at his next visit, otherwise neither surgeon nor patient will have fair play. Even in cases where no medicine is required, it satisfies the patient's mind to have something on the medicine-card, and hence '℞ Haust. Sennæ co. f℥jss. pro re natâ' is a useful prescription.

FRESH AIR is, perhaps, more necessary than medicine for surgical patients, and the house-surgeon should see that the ventilation of the wards is properly carried out, and, if possible, that the windows are opened at certain periods of the day. Attention must, however, be paid to the state of the atmosphere and direction of the wind; for if, with a bitter east wind, windows facing that way are opened, the patients will often suffer severely from catarrh or erysipelas. Window-sashes which direct the current of air upwards can often be opened when the ordinary draughty windows would do much harm to the patients. The use of disinfecting dressings will do away with most of the offensive odour of unhealthy wounds, but, if necessary, cloths may be hung round a patient's bed soaked in some disinfecting fluid, which may also be sprinkled on the floor. A pill-box, perforated with pin-holes, and filled with metallic iodine, is found in the cancer wards of the Middlesex Hospital to be a most effectual deodorant when affixed to each patient's bed; and at Guy's Hospital Dr. Steele contrived a revolving jack-towel in miniature, one end of which passes through a trough containing a solution of carbolic acid, which is thus constantly evaporated in the neighbourhood of offensive or contagious cases. The water-closets and urinals in connection with the wards should be occasionally inspected, to see that they are perfectly sweet, and when the bed-pan is employed it should contain a little disinfecting fluid or powder, and be emptied immediately after being used. Those patients who are able to do so should be encouraged to go out into the fresh air, and all who are able should be up during the daytime, and, if not strong enough to be thoroughly dressed, may lie outside the bed with advantage.

The prevailing custom of constantly scrubbing the floors of the wards with soap and water has a decided tendency to maintain a moist unhealthy atmosphere, particularly in the winter months. The practice of polishing and dry-rubbing the floor, especially if made of teak or some hard wood, is a great improvement, and is found to have a direct tendency to reduce the occurrence of erysipelas.

The house-surgeon should make an invariable rule of seeing all cases of Accident as soon as he is called to them. In the great majority of cases a few minutes' delay would be of no consequence; but as it is impossible to say when the highly urgent cases may occur, the house-surgeon—having due regard to public opinion and the verdict of a coroner's jury—should always give his immediate attendance. The decision as to the necessity for the admission of a case of accident is sometimes a matter of difficulty, and will be influenced a good deal by the number of vacant beds, &c.; but in doubtful cases it is much better to err on the safe side, and take in a patient for a day or two, than to run any risk of mischief occurring during treatment as an out-patient. This is especially advisable for any case brought by the police, and likely to be the subject of legal investigation. Cases present themselves occasionally at hospitals which are obviously unfitted for admission, either from being incurable, or from the fact that they are suffering from want rather than disease. These, if summarily dismissed, may be bandied about between workhouse officials until (as has positively occurred) the unfortunate sufferer has died of inanition in the street. A coroner's jury, finding that admission was refused to a patient in a dying condition, will naturally lay the *onus* upon the house-surgeon, whom it behoves, therefore, to take some little pains to avoid such a misfortune by calling the attention of the lay officials to the case, when they will at least give some nourishment to the applicant before he is dismissed, and possibly take steps to secure his immediate admission into a suitable asylum.

A house-surgeon is a good deal pestered for CERTIFICATES of illness for clubs, &c., and should be provided with printed forms, which can be readily filled up. Caution should be exercised in giving certificates to the police (except when a patient is unable to appear), since the house-surgeon may lose a fee by not having appeared in person at a police-court.

The following are the principal points of LAW affecting the house-surgeon :—

The house-surgeon cannot claim any fee for evidence at an inquest upon a patient who died in the hospital, and it is sometimes a nice point to decide whether a death took place outside the hospital doors or not. If the subject of the inquest was brought in dead, the house-surgeon is entitled to one guinea for giving evidence, and one for the post-mortem examination, provided the coroner has given an order for it to be made; and the house-surgeon should be careful not to give evidence without receiving a summons in due form, and particularly not to make a post-mortem without a written order, or he will forfeit his fees. The house-surgeon must give evidence before a magistrate, if summoned, and there is no fee allowed unless the case be sent for trial, when half a guinea will be allowed for each day's attendance at the police-court; and it is as well to ask the magistrate to enter the attendance at the police-court upon the deposition, so that there may be no mistake after the trial. Although the magistrate has no power to give a fee for evidence on a case which is not sent for trial, the fee of half a guinea may usually be obtained by writing a formal letter to the Secretary of State for the Home Department, Whitehall, stating the circumstances, when in a few days, probably, an order will be received for payment of the fee. At assizes or sessions the house-surgeon is bound to attend on the day he is summoned, and to wait until he is called on, and is allowed a guinea a day for such attendance, and reasonable travelling expenses if he has to go any distance. The fees (including those due for the police-court) are paid as soon as the trial of the case is concluded.

In civil actions the fee will vary according to the liberality of the attorney, but will never be less than a guinea a day and travelling expenses; when served with a *subpœna* to attend, the house-surgeon should receive current coin of the realm sufficient to defray his travelling expenses, or he is not bound to pay any attention to it. When there is doubt of the respectability of the parties, it is well to insist upon having the fee before giving evidence; or, if the attorney refuse this, the house-surgeon should appeal to the presiding judge *before* being sworn, when the judge will direct that the usual fees should be paid: if this is not done, the house-surgeon is at liberty to decline to give evidence. By taking this course of appealing to the judge, the author succeeded once in obtaining the fees for giving evidence in an 'attorney's action,' when a medical friend, who neglected the precaution, failed to obtain any remuneration.[1]

In order that a house-surgeon may fulfil his duties efficiently, it is essential that he should be careful of his own health. The labour, anxieties, and foul air of a hospital produce an effect upon the strongest constitution in a few weeks, and unless the house-surgeon take proper care of himself he will very soon be disabled. A daily cold bath and a daily walk are the great means for maintaining the health and spirits; the walk, particularly, is essential, and is very apt to be shirked, either from want of energy or from over-anxiety for the welfare of the cases. This over-anxiety is not only injurious to the house-surgeon himself, but is bad for the patients also, since it leads to over-frequent visits to the wards, constant change of treatment, and a general state of worry. The house-surgeon should be satisfied with the consciousness of having done his best for his patients, and must be content to leave the result in other hands; and though, no doubt, it is annoying to lose patients in whom a great interest has been taken, it is one of the inevitable drawbacks of medical practice.

A good night's rest is most important for the house-surgeon; but where he is in sole charge of the hospital its attainment is very precarious. On Saturday nights it is, perhaps, of very little use for a house-surgeon to retire early, since the number of broken heads, &c., is generally large at that time; but on other nights there can be no object in sitting up to unreasonable hours, and even half an hour's sleep in bed is better than twice that time in an arm-chair. When the house-surgeon is called up in the night, it will be well for him to take the opportunity of visiting one or two of the wards occasionally, to see that the night nurses are on the alert, and to soothe any sleepless patient.

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[1] The house-surgeon may advantageously study the 'Abstract of the Principal Laws affecting the Medical Profession,' contained in *The Medical Directory*.

In order that the house-surgeon should get through the hard work, both mental and bodily, of his office, it is essential that he should be liberally fed. Committees are not aware sometimes of the hardships they inflict by penuriousness with regard to the medical officers' table; and, undoubtedly, a house-surgeon who does his work *thoroughly*, requires 'meat three times a day.' The first symptom of 'knocking up' is an inability to eat breakfast, which is a most important meal for the house-surgeon, as he has all his rounds to make immediately afterwards, and should therefore be taken in good time, and without the hurry incident to late rising. This is soon followed by a relaxed sore-throat (hospital sore-throat) and a general feeling of depression. An extra allowance of fresh air, by either walking or driving, a couple of glasses of wine, and the internal administration of bark and mineral acids, are the remedies for this state of things; and unless they are soon had recourse to, the house-surgeon may have to throw up his appointment altogether, and seek for health and strength in country air.

CHAPTER I

HÆMORRHAGE

Hæmorrhage from various sources is one of the affections which the house-surgeon is called upon to treat most frequently. Its amount may vary from what is termed 'trifling' to 'alarming,' but it may be of service to the young surgeon to say that there is, probably, no hæmorrhage from the external surface of the body which cannot be arrested, at least temporarily. The ligature and pressure are the two means of arrest in most common use, although the latter (in its varied forms) is not so fully appreciated as it deserves; but recourse must be had occasionally to escharotics and styptics of various kinds, of which the actual cautery is the most potent. The position of the wounded part has considerable influence on hæmorrhage, and should therefore be fully attended to—since, for example, it is obvious that blood will flow more readily from a limb which is allowed to hang down, than from one which is raised to, or above, the level of the heart.

The after-treatment of cases of hæmorrhage, both as respects the wound and the general condition of the patient, is of the greatest importance. Supposing an artery to have been tied on a bleeding surface, no surgeon would think of removing the ligature on the following day; but if pressure alone has been applied to the wound, it must be still more necessary not to interfere rashly with the dressings, and so disturb the natural process of occlusion of the injured vessel. If the hæmorrhage do not recur, there can be no necessity for removing the antiseptic dressings unless they are loosened by discharge from the wound, although it may be advisable to relax the bandages (of necessity tightly applied in the first instance) after a few hours. Perfect rest of the wounded part, and, if possible, an elevated position, are absolutely necessary for successful treatment, while at the same time the whole system must be brought into a condition most likely to conduce to the formation of clot in the vessel and the rapid healing of the wound.

The constitutional treatment of cases of severe hæmorrhage is one of the most anxious cares of the surgeon. On the one hand, there is the immediate danger of the patient's death from exhaustion, and on the other, the fear that by over-stimulation the hæmorrhage may be again induced with equally dangerous effect. It is in these cases that opium is of the greatest service. From one-half to one grain, in frequently repeated doses, will do much to calm the patient's nervous system and mitigate the injurious effects of loss of blood. Stimulants may be cautiously exhibited, provided surgical means have been taken to arrest entirely the flow of blood ; but where, from the nature of the injury, that has been impossible, it would be destruction to the patient to excite immediately the action of the heart, and thus destroy nature's means of arrest. A previously healthy patient will survive a state approaching syncope for many hours, and ultimately make a perfect recovery, while early and injudicious stimulation would have hurried him uncontrollably to the grave. Reaction after hæmorrhage is not usually of a violent character, but, if necessary, may be treated by gentle purgation and small doses of digitalis or aconite.

Among the debilitated patients often met with in hospital practice, anæmia is the difficulty which stands in the way of recovery from a wound. It is in these cases, when the blood seems scarcely able to coagulate, and there is a constant oozing from the wounded surface, that the preparations of iron in frequent doses have such a hæmostatic effect. Of these the Tinctura Ferri Perchloridi seems the best medicine for the purpose, and this, together with small and repeated doses of wine, and a light, dry diet, will materially assist in the recovery of the patient.

Hæmorrhages may be conveniently divided into those which are caused by accident and those which result from disease or follow surgical operations.

HÆMORRHAGE FROM ACCIDENTS

Scalp wounds are very common in hospital practice, and, from the vascularity of the part, generally bleed freely. If no large artery (temporal or occipital) is wounded, pressure alone will be sufficient treatment, and this is best applied by putting the edges of the wound in apposition, after thoroughly cleansing them with warm carbolic lotion (1–20), and dusting with iodoform. Stitches of fine catgut may be advantageously used if there is much separation of the flaps, and the dressing is completed with a pad of iodoform wool and the application of a bandage firmly over the cranium, with a turn or two under the chin to keep everything tight (Chap. VIII.). The hair in the neighbourhood of the wound should be cut close and the immediate edges shaved, and, if dirty, scrubbed with a nail-brush and carbolic lotion, so that both the extent of the injury may be clearly seen and the apposition of the edges may not be interfered with. Should one of the arteries be *divided*, so that the ends are able to retract, pressure will still usually suffice; but if the vessel be only *wounded*, it should be thoroughly divided with a lancet before the edges of the wound are brought together. By everting the edges of a scalp-wound an artery which has retracted, but is still bleeding, may often be found and readily picked up. It is very difficult to apply a ligature on the scalp; and if an artery continue to spout, a good plan is to transfix the edges of the cut and the mouth of the vessel with a harelip pin, over which a twisted or figure-of-8 suture can be passed so as to hold the parts in apposition and arrest the bleeding. The pin should be withdrawn in forty-eight hours. Scalp wounds may of course be accompanied by fracture of the skull, which should therefore be borne in mind, as the hæmorrhage in these cases may come from within the skull, and be beyond the surgeon's control.

Wounds of the face bleed freely, and frequently require a ligature, though pressure can be very well adapted to the parts about the jaws. *Collodion* will frequently arrest the hæmorrhage from small cuts, if applied in the following way :—Grasp the part wounded between the fingers and thumb, so as to blanch it, clean the wound, and put the edges in apposition, drying them thoroughly with a soft rag. Then paint on the collodion, making it cover the skin for some distance around the wound ; let a firm hold be maintained until the collodion is perfectly dry, and then, having allowed the parts to resume their proper position, paint another coat over all. The *Collodion flexile* of the British Pharmacopœia is more tenacious than and not so rigid as the common collodion, and is therefore more convenient for surgical purposes ; it may be conveniently strengthened by applying a very thin layer of cotton-wool before it sets. To attempt to paint collodion on a wet surface, or while the blood is running, is worse than useless, and the same may be said of the application of adhesive plaster under similar circumstances, if warmed in the ordinary way ; but, if immersed in hot water, and carefully applied with a little pressure from a cloth, the plaster will be found to adhere, and to control the hæmorrhage to some extent. If adhesive plaster be applied during the process of healing, it is best done in a number of narrow strips across the wound, each strip slightly overlapping the preceding one. Sutures will often be required in wounds of the face, in order to diminish the width of the scar, and if so, very fine silk, horsehair, or fine catgut sutures are the best.

Cut lip.—Either lip may be cut through by a blow or fall upon the teeth, and the hæmorrhage from the divided coronary artery is generally profuse. The introduction of deep and superficial sutures of dry chromicised catgut or of horsehair with a semicircular needle forms the best treatment; but if a harelip pin and twisted suture be employed, care must be taken to pass the pin sufficiently deeply into the substance of the lip to transfix, or at least go close to, the bleeding orifices of the artery, otherwise hæmorrhage may still go on into the mouth. One or two fine catgut sutures may be advantageously put into the mucous membrane of the lip, which must be everted for the purpose. Unless a piece should have been cut (or bitten) out of the lip, there will be no difficulty in properly adapting the edges of the wound; but the surgeon should bear in mind, as in the operation for harelip, that his proper guide is not the red border of the mucous membrane, but the *line* where the mucous membrane joins the skin. Collodion may be usefully applied over the twisted suture when the ends of the pin have been cut off. Two days are generally sufficient for the pin to remain in the lip, but the scab should be left untouched until it drops off spontaneously.

Bleeding from the nose, the result of a blow, is generally slight, and may be alleviated by the application of cold water; although the usual position assumed by the patient, that of bowing the head over the basin, is little calculated to assist in its arrest. It is much better to make the patient sit erect and hold a sponge to the nose, or in slight cases sniff up the cold air, which will often prove sufficient.

Bleeding from the ear, after a blow, is generally caused by slight rupture of the lining membrane of the meatus or of the membrana tympani, which can be easily seen through an ear-speculum, and must not be taken as a symptom of fractured skull, unless it is in large quantity or is accompanied by other evidence of injury.

Bitten tongue may give rise to severe hæmorrhage if the wound happen to be in the thickness of that organ. Ligatures are of little avail, as they almost invariably pull off; and if cold does not arrest the flow of blood, torsion or the actual cautery should be applied to the bleeding points. Sutures are difficult to apply, and are of very little use in wounds of the tongue; and unless the piece is nearly severed from its connections, so that the surfaces of the wound are unlikely to come into apposition, it is better to trust to nature and the healing powers of the saliva.

Teeth knocked out seldom give rise to severe hæmorrhage of any duration, and cold water forms the best treatment. If the tooth (particularly an incisor) is sound, an attempt should be made to replace it in the socket, as it may possibly become again attached. A piece of silk should bind it to the neighbouring teeth, in order to keep it in position.

Cut throat.—If the large vessels of the throat are divided by the knife, immediate death will ensue before the surgeon is called; but this is not a common occurrence, for attempts at suicide being generally made in the space between the hyoid bone and thyroid cartilage, the incision does not go near the carotid arteries. There is often sharp hæmorrhage at first from two or three small arteries, if the incision is severe, but this may easily be arrested by ligatures or torsion, if the cold air has not already been sufficient to stop the bleeding. The incision will vary considerably both in size and depth; an incision 'from ear to ear' may be only skin deep, while another of smaller extent may have divided the trachea and even the œsophagus. The patient is generally in a very depressed condition, partly the result of loss of blood, but mainly owing to the mental condition which gave rise to the attempt, aggravated occasionally by bodily want. In this case it may be advisable to administer at once a small quantity of nourishment, such as a couple of tablespoonfuls of beef-tea and one of brandy, and to repeat it at short intervals. If the pharynx is uninjured this can be readily swallowed, but if it is wounded (it is very seldom entirely divided) the stomach-pump must be used, the tube being introduced with great care, and the finger, if necessary, inserted in the wound to insure its taking the right direction.

1 oz beef T
1/2 oz Brandy
frequently

Until recently the usual practice was not to put sutures in a cut throat, on the ground that they would cause any blood which might be effused to enter or press upon the windpipe, and, by retaining blood or pus within the wound, would prevent its granulating from the bottom. If, however, all hæmorrhage be arrested, and the wound rendered aseptic, there appears to be no reason why a clean cut, however deep, should not be closed by sutures. Of course, if the breathing should become embarrassed, the wound must be re-opened without delay, and in some cases it is a good plan to introduce a tracheotomy tube into the trachea, or even to do an independent tracheotomy. Occasionally, when the thyro-hyoid membrane is so completely divided that the larynx drops out of position, it may be necessary to suspend it by deep sutures attached to the hyoid bone and the thyroid cartilage.

The position of the patient is the great thing for effecting a cure. If the first faintness has gone off and all hæmorrhage has ceased, the patient's shoulders should be raised by pillows, so as to make the head bow forward, and if the necessity for this position be explained to him, it will be found sufficient, provided the patient is sane. In insane or unruly cases it will be better to carry a bandage round the forehead, and bring the ends from the temples down to a waistband in front.

The great danger in cases of cut throat, after the immediate consequences of hæmorrhage and shock are past, is inflammation of the lungs, owing to the entrance of cold air and septic matter through the wound. This is best obviated by the application of hot moist boric lint, folded and laid lightly over the wound beneath oil-silk, and renewed as often as it becomes cold or dry. The boric lint tends to help the granulating process and to keep the wound sweet, and this may be aided by blowing a little iodoform into the wound occasionally. Great care must be taken to support the patient's strength during the first few hours after the injury, by the administration of food and stimulants by the mouth if possible, or if not by enemata per rectum.

Ruptured frænum.—Patients have been known, on several occasions, to apply at a hospital faint from loss of blood caused by a rupture of the *frænum præputii.* Since the continued bleeding depends upon the fact that the little artery of the frænum has been only partially divided, the obvious treatment is to snip it across with a pair of scissors, when the hæmorrhage will cease immediately.

Stabs may be inflicted in various parts of the body, and give rise to a varying amount of hæmorrhage.

(*a*) *Stabs in the throat* may be treated on the same principles as cut throat—viz. to stop the bleeding and make the wound aseptic, so that it may heal rapidly. A complication which may arise in stabs in the throat is where the knife has perforated the trachea and emphysema is produced, owing to the wound not being sufficiently large or direct for the air to escape through it. A pad of lint and a bandage, gently applied, form the best treatment, and the emphysema is generally but slight, and will gradually disappear.

(*b*) *Stabs in the chest* may produce hæmorrhage by wounding (rarely) an intercostal artery, or the lung. An intercostal artery may be twisted or tied, and seldom gives much trouble; but, if necessary, the wound may be effectually plugged by pushing into the pleural cavity a piece of a pocket-handkerchief, and filling it with cotton-wool, which can be made to exert pressure upon the edges of the incision by drawing upon the portion of the handkerchief outside the chest. Wound of the lung (generally shown by bloody expectoration) may be irremediably fatal from hæmorrhage, the blood either pouring from the mouth or choking the lung, or more rarely filling the pleura and compressing the lung. The great object is the immediate arrest of the hæmorrhage by the inhalation of the vapour of turpentine sprinkled on a handkerchief, the application of cold both to the surface of the chest and by swallowing ice, and lastly by venesection, if necessary. Venesection for this purpose should be performed while the patient is supported in the erect posture, and the blood should be drawn from a large aperture, so as to induce a fainting condition as rapidly as possible; and care must be taken that the patient be not allowed to recover his heat and rapid circulation too soon, or the hæmorrhage may recur. An early opportunity should be taken of administering one of those drugs which have a hæmostatic tendency (*e.g.* Plumbi Acetatis gr. j. in pil.; or Acidi Gallici gr. v.) in repeated doses.

(*c*) *Stabs in the abdomen* may give rise to hæmorrhage from wounding vessels in the parietes, and these can be easily secured; but apparently slight wounds may perforate the peritoneum and wound the intestines, giving rise to internal hæmorrhage, and as an exploratory operation may be advisable, the visiting-surgeon should be summoned without delay. The forefinger, thoroughly cleaned and carbolised, is the best implement for ascertaining whether the wound has penetrated the peritoneum or not, and whether the intestine is wounded. In the latter case the presence of fæces, or at least a fæcal odour on the finger, will be all-important, and possibly gas may be seen to bubble from the wound. Simple wounds of the parietes should be closed at once with sutures. The sutures should be made to go through the edges of the peritoneum if opened, so as to secure its early union by adhesion, and should be of carbolised silk. Intestines, if wounded and exposed, should be stitched up with fine silk or catgut sutures, passing through the peritoneal and muscular coats only, so as to bring the two surfaces of the peritoneum into apposition. (Lembert suture.) Whatever the injury, the sooner the patient is got fully under the influence of opium the better, so as to guard against peritonitis.

Wounds of arteries require varied treatment, according to the size of the vessel and the kind of injury inflicted. Fortunately, these injuries occur mostly in the extremities, where pressure can be readily adapted to the limb, and it is to pressure alone that recourse should be had in many of the wounds of small vessels.

Whenever there is sharp hæmorrhage, probably arterial, from a wound, pressure should be immediately made upon the main artery with the fingers, so as to stop the bleeding temporarily. This immediately relieves the anxiety of the patient and friends, and also permits a careful examination and cleansing of the wounded part with *cold* carbolised water. If this is done deliberately, and the wound is further exposed for a few minutes to the air, possibly, on the relaxation of the pressure above, no further hæmorrhage will take place. Should it return, however, careful inspection should be made to discover the bleeding point. Supposing this possible, which is not always the case, and a bleeding artery to be discovered, if of large size a ligature may be applied, or if small it may be twisted, or pressure may be adapted in the following manner:—An assistant again holding the main artery, and the wound having been again thoroughly cleansed, the surfaces should be laid together and a pad of dry lint placed over the wound and adjacent skin, so as to press the cut surfaces closely together. A bandage, carried first round the limb for some distance below the wound, should be applied tightly over the pad, and then be carried a short distance above the wound, additional pads being placed, if considered necessary, along the course of the principal arteries, so as to exert pressure upon them.

Should bleeding again occur, *graduated pressure* may be used in the following way:—The main artery being held as above described, the wound is to be laid open, and a small pledget of folded lint placed at the bottom, on this another pledget rather larger, and so on until the lint is an inch thick above the skin, pressure with the bandage being then exerted on the whole, with the same precautions as before. The addition of a piece of cork or of a small coin wrapped in lint renders the graduated compress firmer and more effectual. The disadvantage of this otherwise very effective method is, that the wound must necessarily be allowed to granulate from the bottom, thus occupying a longer time in healing and leaving a larger scar.

The position of the limb after the application of pressure is of the greatest importance; thus the hand should be raised by a sling to the opposite shoulder, so as to flex the elbow, while the foot and leg should be supported above the level of the body by pillows.

(It is never sufficient simply to tell a patient to keep a wounded or inflamed arm in a sling, for the limb is then generally allowed to hang down, but the surgeon should himself see that the hand is raised to the opposite shoulder.)

The above directions are only applicable to wounds involving the smaller arteries of the limbs. In cases of injury of the main trunks, the profuse hæmorrhage should be instantly controlled by pressure of the finger upon the artery above the wound, until a tourniquet can be applied, which, although it arrests the rush of arterial blood, will very probably still leave a strong current of dark-coloured blood ebbing out of the wound. This blood, which may come from the lower end of the wounded artery, from the vein, or from both, will be immediately controlled by another tourniquet placed below the wound, until the assistance of the visiting-surgeon can be obtained, since operative interference of some kind will certainly be required.

Patients who have received, a few days before, a wound of the principal artery of a limb, which has been treated by bandaging, are occasionally brought to a hospital on account of a continual oozing, or perhaps a sudden gush of blood; and on examination a tumour is found, with a small orifice from which the blood emerges. The house-surgeon is cautioned against interfering with such a case further than to put a tourniquet on the artery; for the tumour is probably a false aneurism of large size, and will require an operation of no small moment for its cure.

Wounds of the palmar arch are sometimes laid great stress upon, as if their treatment differed in any way from that of wounds of arteries generally. A tourniquet should be temporarily applied while the wound is examined, and if no bleeding vessel can be conveniently tied or twisted, recourse must be had to pressure, which may generally be relied on, provided the parts are not interfered with and the dressings disturbed too early. The fingers and thumb should be carefully bandaged, and a firm graduated compress having been applied to the bleeding point, the hand and arm should be firmly bound upon a back splint;

and it may be well, as an additional precaution, to make pressure upon the radial and ulnar arteries at the wrist with pieces of elastic catheter wrapped in lint beneath the bandage. The elbow is then to be fully flexed, and the hand bound up to the opposite shoulder.

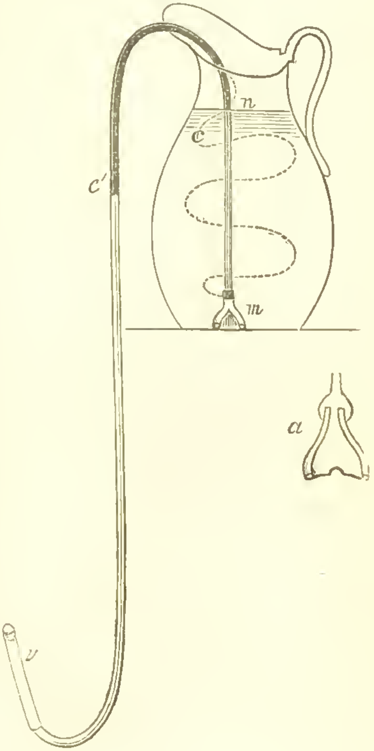
Wounds of veins give comparatively little trouble, and the hæmorrhage is readily arrested by pressure, if the vein is of moderate size. A ligature may occasionally be required on a large vein, and may be applied without much apprehension as respects phlebitis.

HÆMORRHAGE FROM DISEASE

Bleeding may occur from vascular or malignant growths on the surface of the body, and, from the low condition of the patient, it may be highly desirable that as little blood as possible should be lost. As the source of the hæmorrhage is generally rather a surface than any one bleeding vessel, the ligature is seldom applicable, and from the nature of the case pressure can hardly be applied; hæmostatics therefore must be employed, such as the Liquor Ferri Perchloridi fortior, the Liquor Ferri Persulphatis, the solid Nitrate of Silver, and Nitric Acid, or, in extreme cases, the actual cautery.

In dealing with vascular growths, it will be advisable to surround the mass with a ligature and tie it by one of the numerous methods described in surgical works, or more simply by passing a needle or harelip pin beneath the bleeding tissue, and then carrying a thread around it.

Epistaxis, or hæmorrhage from the nose of spontaneous and constitutional origin, may be treated *locally* by the application of cold to the head and face, or better by the injection into the nasal cavities of water as hot as the patient can bear it, by the inhalation of vapour of turpentine, or by the use of powdered alum as a snuff. The method of washing out the nose advocated by Dr. Thudichum offers great advantages in the treatment of epistaxis. It is based upon the physiological fact that, when a patient breathes through the mouth alone, the soft palate so effectually shuts off the posterior nares that fluid may be injected into one nostril, and will pass round the septum and out of the other nostril without entering the mouth. Various forms of irrigator have been devised for this purpose, but the plan can be readily carried out by means of an india-rubber enema apparatus; or, if cold water is employed, still more simply by attaching a rectum-tube to a common water-tap, by which the force of the stream can be readily moderated.



The most convenient form of apparatus, and one which has been employed by the author with advantage in the treatment of ozæna, is the simple vaginal douche, contrived by Dr. Rasch, and shown in fig. 1. It consists simply of a stout india-rubber tube, five or six feet long, with a perforated weight (*a*) at one end, so grooved that water can pass through it when standing on a flat surface. At the other end is an ordinary gum-elastic enema nozzle, which may be perforated with more than one hole if preferred. In using the instrument, it is only necessary to have an ordinary bedroom ewer filled with water, when the weighted end is dropped into it, and the tube 'payed in' for two or three feet and left for a couple of minutes. The ewer being then raised upon a chest of drawers, or some convenient elevation, the tube is squeezed below the level of the water (*c*) and drawn over the lip of the ewer (*c*′), when, being converted into a siphon, the water immediately begins to flow along it. Perfect control can be exercised over the water by the pressure of the finger and thumb of the surgeon, whilst the patient places his head over a basin

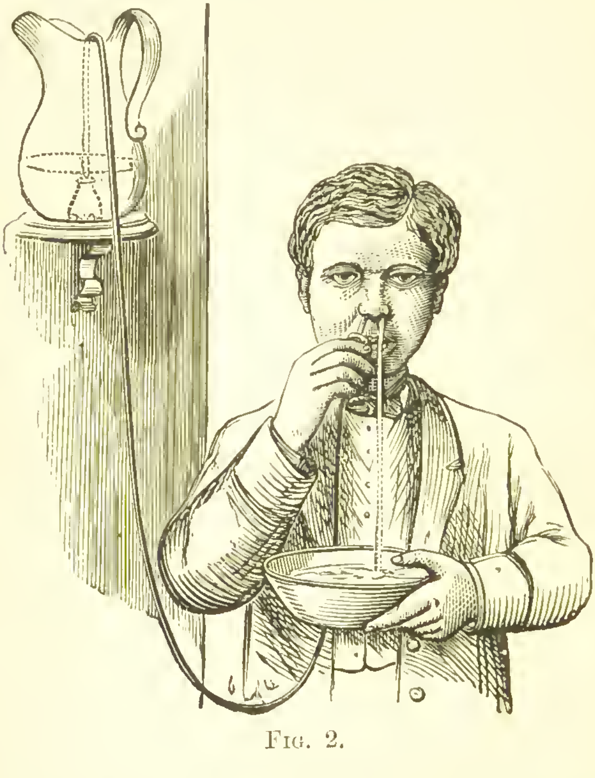


Fig. 2.

and has the nozzle inserted into his nostril. On permitting the flow of the water, a stream is immediately established between the nostrils so long as the mouth is kept open, and the current can be reversed, arrested, or diminished with the greatest readiness (fig. 2).

A more portable form of siphon nasal douche consists of an india-rubber tube, weighted and fitted with a metal mount to prevent collapse against the edge of a tumbler. The other end is fitted with an india-rubber teat, which effectually plugs the nostrils so that water can be sniffed up when the other nostril is closed. The tumbler being raised, the siphon action is then complete, and the water flows out of the opposite nostril, provided the patient keeps his head forward and his mouth *open*.

The tube should be made to slip through the mount so that the length of the weighted end can be adjusted to the depth of any tumbler or jug (fig. 2). The instrument may then be conveniently employed for irrigating or cleansing wounds, especially about the nose or mouth, or may be used for feeding helpless patients, either by suction through the teat or by the siphon action.

In persistent or recurring epistaxis it may be necessary to plug the nares (*v.* Minor Operations).

Hæmorrhage from the rectum, if venous, is generally the result of gorged hæmorrhoidal veins, and may be treated by enemata of cold water, or some astringent decoction, such as the Decoctum Quercûs, or Tinctura Hamamelidis, f ʒj in three ounces of cold water. If arterial and severe, the bleeding point may be touched with nitrate of silver or the actual cautery through a speculum, the rectum being afterwards carefully plugged with lint, to which a string should be attached to prevent its getting out of reach. A more efficient way of plugging the rectum is to push a flat sponge, with a string attached to it, a good way up the bowel; then to fill the space below with lint. When this is done, by pulling on the string the lint is compressed between the sponge and the anus, and exercises pressure on the bleeding mucous membrane. Careful after-treatment will be requisite to relieve the loaded condition of the vessels, and probably an operation for the cure of the piles. Hæmorrhage from the bowel in children is not unfrequently caused by a polypus in the rectum, which will require removal before the affection will be cured.

Hæmorrhage from the bladder, if in large quantity, may result from vascular tumour, or if slight, from the presence of a stone. The injection of cold water through a catheter will generally suffice, the instrument being retained in the urethra, so as to allow any blood which may flow to escape at once, and not coagulate in the bladder. In severe cases, weak astringent solutions may be injected, and ice be placed in the rectum and about the pubes. The internal administration of Gallic Acid and Tincture of Iron may be employed in these cases, but the most effectual remedy is turpentine in ten-minim doses suspended in mucilage. An early opportunity should be taken to ascertain the presence of a tumour or calculus by means of the sound; and if one exist, the patient had better be at once admitted into the hospital, or very possibly, the hæmorrhage having ceased, he may never appear again for the necessary treatment.

The following will assist the house-surgeon in arriving at a correct diagnosis as to the source of bloody urine. If the blood come from the kidney, it will be thoroughly mixed with the urine, rendering it of a smoky colour if in small quantity, or dark-red if more abundant. When the hæmorrhage is from the bladder, the first portion of the urine may be pretty clear, and the blood will be clotted and more abundant as the viscus contracts. If from the urethra alone, it will be found that the first gush of urine is mixed with blood, but that afterwards it is clear, being again bloody at the last, when possibly a few drops of nearly pure blood may be ejected. Blood from the urethra, if in quantity, will trickle out before any effort at micturition is made.

Ruptured varicose veins in the lower extremities give rise to dangerous hæmorrhage. The patient may be unaware of the accident, and fall down in a fainting condition, which may rapidly become fatal if not attended to. Pressure upon and below the wound immediately stops the bleeding, but the limb should be carefully supported in an elevated position for some time after the accident, to prevent its recurrence. The veins of the labia sometimes give way in pregnant women : cold, the horizontal position, and pressure form the appropriate treatment.

Ulceration and sloughing may give rise to very severe and even fatal hæmorrhage by opening into a large vessel. Here the temporary arrest by pressure on the main trunk, and the subsequent adoption of the treatment proper for wounds of arteries (p. 21), must be had recourse to ; although in some localities, as in the throat after scarlet fever, &c., the hæmorrhage is beyond the surgeon's control, and will prove fatal.

HÆMORRHAGE AFTER SURGICAL OPERATIONS.

Hæmorrhage after extraction of teeth is sometimes troublesome, particularly in feeble patients. It is best treated by careful and forcible plugging with a strip of lint soaked in some styptic, which is to be thrust bit by bit into the socket until it projects beyond the neighbouring teeth ; the pressure of the opposite jaw, maintained by a bandage under the chin, will then keep it sufficiently tight.

In children the subjects of an hereditary tendency to bleed (*hæmorrhagic diathesis*) considerable trouble may be experienced in arresting hæmorrhage from this cause. The lint should be steeped in the Liquor Ferri Pernitratis, and the patient should take full and repeated doses of Tinctura Ferri Perchloridi with dilute Hydrochloric Acid.

Hæmorrhage from the tonsils may follow either the puncture of an inflamed tonsil or the removal of one which is chronically enlarged ; and the former is naturally the more severe accident. The blood comes only from the branches of the artery to the tonsil, and never from the internal carotid ; and if gargling with iced water fail to arrest the hæmorrhage, the Tinctura Ferri Perchloridi, or, still better, the Liquor Ferri Perchloridi, or Liquor Ferri Pernitratis (B.P.), may be almost certainly depended upon to stop it. The fluid should be applied by means of a small sponge or piece of lint, attached to a piece of stick, and must be held firmly against the bleeding point for some minutes.

In bleeding from the tongue and back of the throat, great advantage may be derived from the use of one of the 'spray producers' in common use, employing as a styptic the Glycerinum Acidi Tannici (B.P.) in the proportion of one to six parts of water, or the *Styptic Colloid* of Dr. Richardson. Or the patient may advantageously swallow slowly a teaspoonful at a time of the following solution recommended by the late Sir Morell Mackenzie : Acidi Tannici gr. 360, Acidi Gallici gr. 180, Aquæ f℥j.

Hæmorrhage after operations on the tongue is usually severe, one or both lingual arteries being involved. The arterial bleeding can be promptly arrested by passing the forefinger down to the epiglottis and hyoid bone, and drawing the base of the tongue upwards towards the chin. All bleeding being thus temporarily stopped, the mouth can be cleansed of clots and the bleeding artery easily found and picked up, owing to the stump of the tongue being fixed with the finger. In the case of mere oozing from the vascular surface of the tongue the application of a piece of sponge, which should be pressed upon the part with the fingers for a few minutes, and then be left *in situ* till loosened spontaneously, is very effective. Iodoform sprinkled on the sponge or applied to the surface forms a most efficient antiseptic.

Leech-bites give trouble occasionally; and should cold and pressure fail to stop the bleeding, a fine-pointed stick of nitrate of silver may be inserted into each wound. As a last resource a horsehair suture may be introduced with a needle, or a harelip pin may be inserted through the skin so as to transfix the bite, and a twisted suture be placed over it.

Intermediary hæmorrhage is that occurring soon after an operation, when reaction has supervened. Small vessels, which did not bleed at the time of the operation, may begin to do so on the patient becoming warm in bed, and the bandages, &c., will become more or less stained with blood. This need occasion no alarm unless the blood soak completely through, and begin to drip away from the dressings, when immediate steps must be taken for its arrest. In the case of a stump after amputation, for instance, the soaked dressings should be removed, and the stump raised and firmly bandaged, while gentle pressure is made upon the main artery with the finger or a tourniquet. If these measures arrest the bleeding, fresh dressings may be applied; but the limb had better be elevated, and the pressure gently maintained for a few hours, to avoid its recurrence. If this treatment should not succeed, the sutures must necessarily be divided and the surfaces of the wound separated, in order that a ligature may be applied to the bleeding point; or if, for any reason, that is impracticable, a fine-pointed actual cautery may be had recourse to as a last resource. Intermediary hæmorrhage after other operations is often more troublesome to treat than after amputation: for example, in resection of the knee-joint an oozing may take place, but as no large vessel has been divided, and perfect rest is essential for the success of the operation, a house-surgeon should avoid opening up the wound and displacing the bones to look for a small vessel, which pressure and time would probably treat more satisfactorily. The same may be said of compound fractures, &c.

Hæmorrhage after incisions into inflamed parts.—Incisions into inflamed tissues will often bleed profusely, and the patient may lose more blood than is either necessary or advisable. Strips of antiseptic gauze should be packed into each incision so as to fill it to the surface, and an antiseptic fomentation be placed over all; a bandage should then be lightly applied, and the limb, if possible, kept in an elevated posture. The fomentation should be renewed every four hours, but the gauze should not be disturbed for twenty-four hours.

Secondary hæmorrhage may occur in a wound from the vessel not having become occluded, or it may result from sloughing having opened up vessels not previously implicated. Another and more formidable variety is where ligature of an arterial trunk has been performed, and hæmorrhage occurs some days after, when the wound is nearly healed. Immediate arrest of the hæmorrhage by pressure upon the main artery is of course the first object, and then, should the surfaces of the wound or stump be only partially united, an effort may be made to place a ligature upon the bleeding vessel; when, however, as is often the case, the greater part of the wound has healed, the assistance of the visiting-surgeon should be at once obtained, since it will be a question whether the adhesions should be divided and the wound re-opened, or a ligature placed upon the main artery higher up in the limb. Even in cases where the vessel can be reached, it is often impossible to isolate it from the surrounding tissues, and the only method of proceeding is to carry a thread as close round the vessel as may be, by means of a sharp-pointed aneurism-needle, and to tie it and the surrounding structures *en masse*.

In secondary hæmorrhage after ligature of an arterial trunk two tourniquets will probably be required, one above, the other below the bleeding point, since the already re-established circulation will bring a full current of blood to the lower end of the vessel. Here, if pressure fails, it may be required to dissect out and tie the vessel at the bleeding point or immediately above, or to place a fresh ligature on the main trunk nearer the heart, and the assistance of the superior officer must be immediately obtained.

In all cases in which secondary hæmorrhage may possibly occur, it is a useful precaution to mark with ink the spot where pressure should be applied; and both the nurse and the patient should be shown how to make pressure with the finger in case of any sudden emergency. When there is any real probability of hæmorrhage occurring, a tourniquet should be kept constantly but loosely applied to the limb, so that it may be put in action at a moment's notice.

Hæmorrhage after perineal cystotomy may be both intermediary and secondary. There is often a little oozing of blood after the patient is put to bed, which may be checked by bringing the thighs together with a turn of bandage, and exposing the perinæum to the cold air; but occasionally there is a sharp flow of arterial blood a few hours after the operation, sufficient to blanch the patient if he is very young. If the bleeding vessel can be seen, it should be tied or twisted ; and if not, cold water may be injected *per urethram* and allowed to run through the wound, and ice can be placed in the rectum. The most effectual method of checking hæmorrhage, both at the time of and after the operation, is to plug the wound around a *tube en chemise* passed into the bladder. This gum-elastic tube, of from six to eight inches in length and half an inch in diameter, is perforated with holes at one end and fitted with two rings at the other. A sort of petticoat is formed around the tube by pushing it through a hole in the centre of a square piece of calico, which is then to be firmly tied around it about an inch from the end, as seen in fig. 3. Into this a quantity of lint or cotton-wool can be introduced when the tube is *in situ*, and thus the wound be effectually plugged without risk of foreign bodies entering the bladder, and the whole can be withdrawn with the greatest ease. The strings attached to the rings pass in front of and behind the

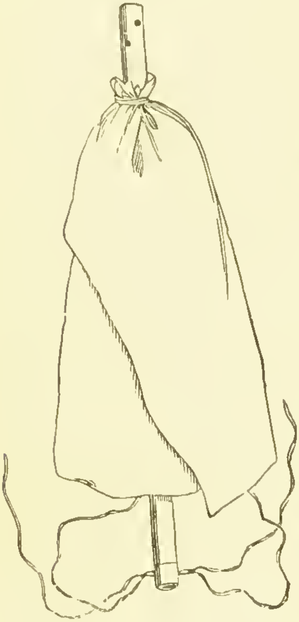


FIG. 3.

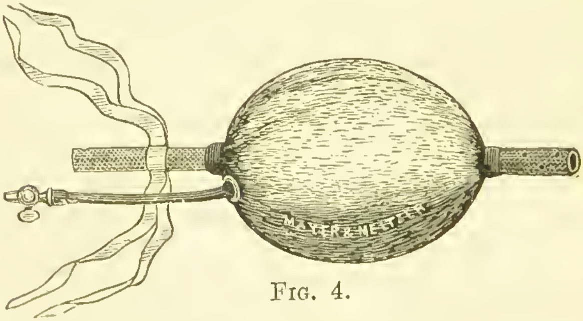


FIG. 4.

body of the patient, and are fastened to a band round his waist. If the rings are wanting, the strings can be effectually attached to the tube (or a common catheter for children) with clove-hitches.

Mr. Buckston Browne's ingenious elastic lithotomy tampon (fig. 4) is a more efficient and cleanly apparatus, being made entirely of india-rubber, with a movable muslin cover which prevents over-distension. Being introduced into the wound in a collapsed condition, the ball is distended with air, so as effectually to arrest hæmorrhage, while the centre tube allows of the escape of urine.

APPLIANCES FOR ARRESTING HÆMORRHAGE

Pressure with the finger, if applied on the proper spot, is always sufficient to stop the current of blood in an artery. If possible, pressure should be made against a bone, and not against muscles, which offer but slight resistance; thus the *brachial* artery should be compressed with the fingers against the humerus (fig. 5), and the *femoral* with both thumbs upon the edge of the pubes (fig. 6). The *subclavian* can be compressed above the clavicle against the first rib with the thumb, or, what is better, the handle of a door-key wrapped in lint.

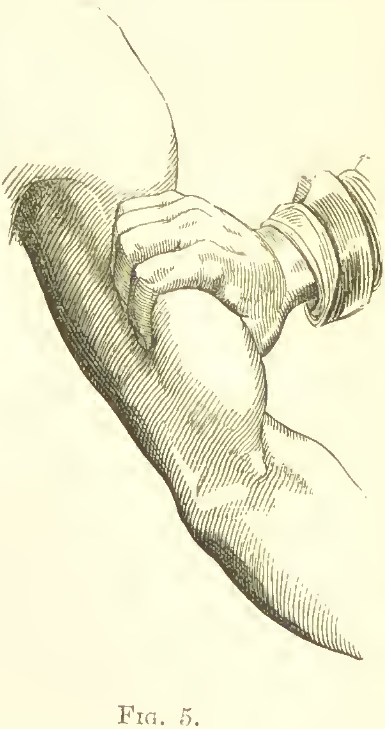


Fig. 5.

Tourniquets are of several kinds. The ordinary one, or Petit's (fig. 7), is the least likely to slip, but has the disadvantage of impeding the venous circulation, and is therefore inapplicable for lengthened use. The pad placed upon the strap of this instrument is generally too small and had better be removed, its place being supplied by a small roller about an inch and a half wide, which should be placed under the strap of the instrument, and over the artery. It will be found most convenient to place the screw of the instrument on the outer side of the limb, except in the case of the popliteal artery, where it should be placed directly over the knee (fig. 7). The buckle of the strap often gets drawn up close to the brass-work,

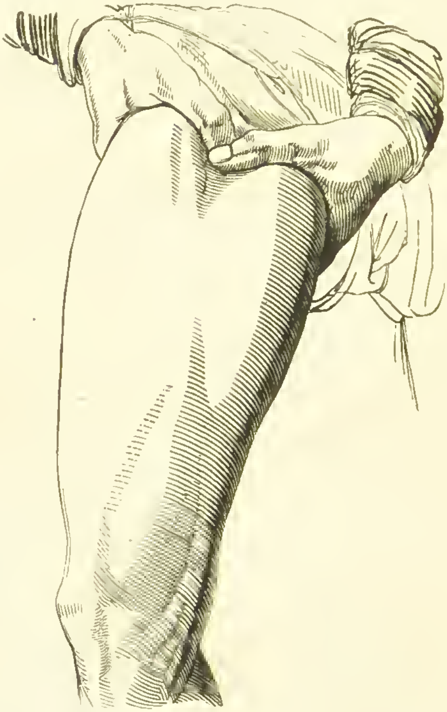


FIG. 6.

and would impede the action of the screw; care should therefore be taken that a few inches of strap intervene before the instrument is applied. It will be found impossible to apply this instrument so high up on the femoral artery as either the finger or other forms of tourniquet; neither is it applicable to limbs which have two main arteries.

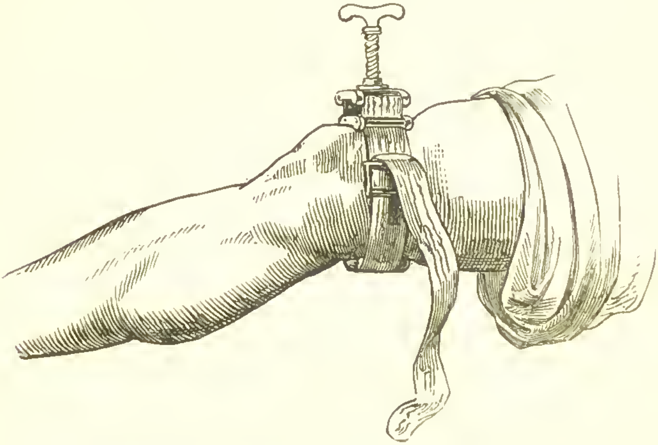


FIG. 7.

Esmarch's bandage and cord are very effectual means for rendering a limb bloodless previous to an operation. The elastic bandage, rolled like an ordinary bandage, is to be applied firmly from the toes or fingers to a point well above the seat of operation, any open sore being protected with a piece of oil-silk. The elastic cord is then wound twice or thrice round the limb over the highest turn of the bandage, being pulled as tight as can be conveniently done, so that the elastic tension may be complete. On removing the bandage the limb will be found blanched and pulseless, and will remain so as long as the cord is tight. The pressure of the round cord may prove injurious when, as in the arm, the large nerves are superficial and therefore liable to be compressed. A few turns of the elastic bandage, one over the other, form an equally efficient and safer tourniquet.

Samway's tourniquet (fig. 8), which is employed at Guy's and St. Thomas's hospitals, consists of a metal anchor to which the elastic cord is fastened.

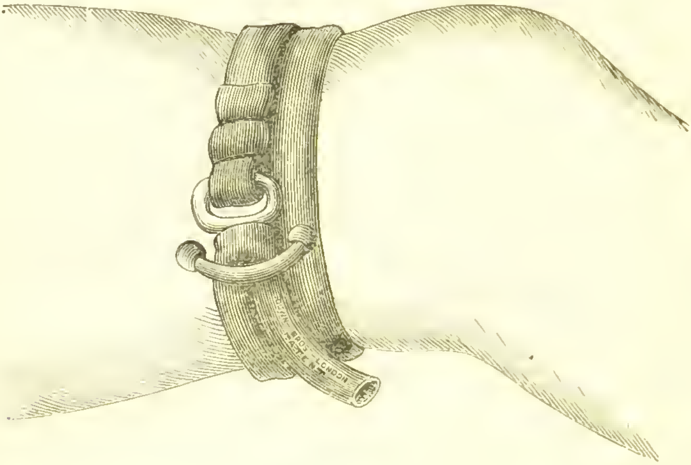


Fig. 8.

In the case of an amputation, the main arteries will be secured before the cord is loosened, but an assistant should always be ready to compress the main vessel with his thumb, so as to prevent loss of blood while the smaller arteries are being secured. In the case of an operation for necrosis, the wound should be packed with gauze and a bandage be applied before the cord is loosened, so as to obviate almost entirely all loss of blood ; but caution must be exercised lest the bandage be applied so tightly as to prevent the return of blood into the limb and thus endanger its vitality A good test of sufficient blood-supply is to compress the toe-nail, and see if it blanches thoroughly and then rapidly regains its colour.

For fingers, an ordinary india-rubber ring, or, better, a round 'umbrella-ring,' may be used, and, if rolled up the finger from tip to base, renders the operation bloodless. A similar ring may be conveniently used for the penis in cases of circumcision, or one of larger size for the limbs of infants or young children. A piece of drainage tube, fastened with a pair of Wells's catch-forceps, answers equally well.

Signoroni's tourniquet (fig. 9) is chiefly applicable to the upper part of the femoral artery, the hollow pad being applied to the outer and back part of the limb, and the convex one screwed down upon the vessel. This is a very effective instrument in this position, provided the bed-clothes are prevented from touching it; but in other positions it will be found difficult of application, and very liable to slip off.

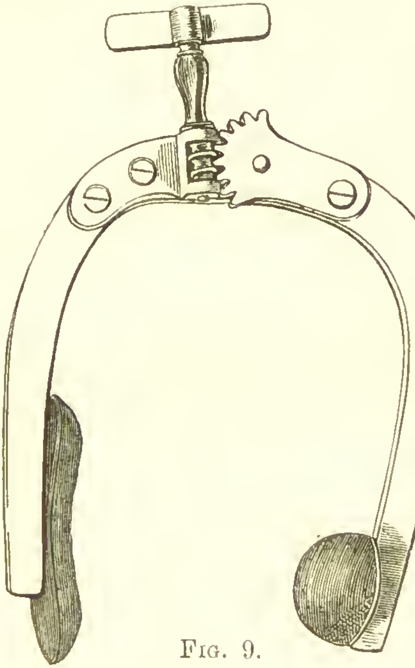


FIG. 9.

There are two or three varieties of field-tourniquet, consisting essentially of a strap, buckle, and pad, which can be readily applied ; or in case of sudden emergency, a tourniquet may be improvised out of a handkerchief tied firmly round the limb, with a stick twisted in it to keep up pressure.

Forceps are the best instruments for seizing a bleeding vessel, and of all the varieties which have been invented, a pair of ordinary dissecting-forceps, broad and well serrated at the extremities, is the best for the operator, who readily seizes the vessel and probably a small amount of tissue with it ; but it is not so convenient for tying the ligature upon as the artery-forceps, made to meet at a sharp point. The spring of the forceps should not be too feeble, since a slight resistance in the instrument materially assists in catching a bleeding vessel.

Coxeter's catch *artery-forceps* (fig. 10) is a very useful instrument, especially for picking up a vessel close to a bone, but it has the disadvantage that it transfixes the tissue it grasps, and may thus inflict an injury upon the coats of a large artery when the attempt is made to seize a small branch cut short.

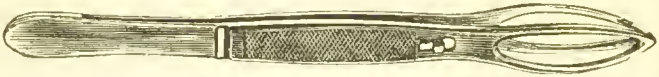


FIG. 10.

Sir Spencer Wells's *forci-pressure forceps* (fig. 11) is a very convenient instrument for picking up bleeding vessels during an operation, since the catch enables the forceps to hang on until the operation is completed. Several pairs of forceps may thus be applied, and the pressure alone will, in the case of small arteries, be found to have permanently arrested the bleeding ; but with larger vessels it will be necessary to adopt torsion, or to apply a ligature in addition. In order to do this last satisfactorily, the handle of the forceps should be depressed and the points raised to allow the ligature to slip over it.

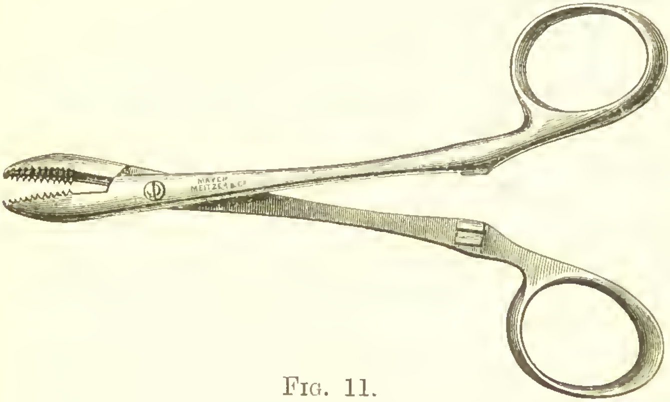


Fig. 11.

The Ligature should be of hemp or carbolised silk, or of carbolised or chromicised catgut if strict antiseptic precautions are to be adopted in the after-treatment; and a little study of the best and most rapid way of tying a ligature will amply repay the house-surgeon. The object is to tie a 'reef-knot,' which is certain to hold, and not what is nautically termed a 'granny,' which is very likely to slip. The difference between the two knots will be best appreciated by the diagrams below (fig. 12), where the reef-knot is marked A and the granny B.

It will be observed that in the 'reef' both the ends of the thread pass either over or under the corresponding loop, while in the 'granny' one thread is over and the other under; the result of which is that the loops are not so flat, and when pulled tight do not come so closely together, or hold so firmly, as in the true 'reef-knot.' Any one can satisfy himself of this in a moment by tying the two knots on a piece of string and comparing them. The secret of invariably tying a reef-knot is to make the same thread uppermost or undermost both in the first and second tying.

This can be, and is, accomplished by many surgeons by changing hands after the first tying, which always looks awkward and wastes time. A much better method, but one which requires a little practice to learn thoroughly, is the following:—The ligature, which should be sixteen inches long, is to be held in the palm of the (right) hand between the thumb and forefinger; the end is then to be thrown round the forceps loosely and caught with the left hand; the right hand is now brought under the end in the left, when

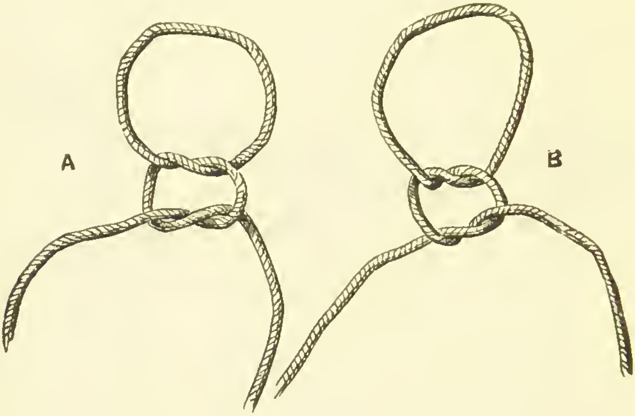


FIG. 12.

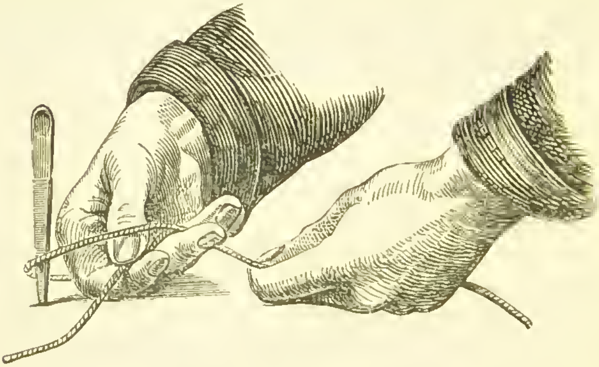


FIG. 13.

that end is to be crossed over the right thumb and inserted between the third and fourth fingers of the right hand (fig. 13); the left hand at the same moment seizes the other end, and thus an interchange is effected and the ends of the threads are drawn out, as is being done in fig. 14. There will now be no difficulty in drawing the knot thus formed tight with the forefingers, or, if preferred, with the thumbs (fig. 15). To complete the knot by making another tie, the same manœuvre is to be repeated, taking care always to begin with the opposite hand to that which began before. It is quite immaterial which hand begins the first part of the knot, so long as the *opposite* one always begins the second part; and in this way, with a little practice, the reef-knot may be unerringly tied with the greatest rapidity. Some people may possibly think that the above directions more resemble those for the performance of a conjuring trick than a surgical operation; but it is surely well worth a surgeon's while to attain the greatest possible dexterity in the use of his fingers, both for his own and his patients' sake.

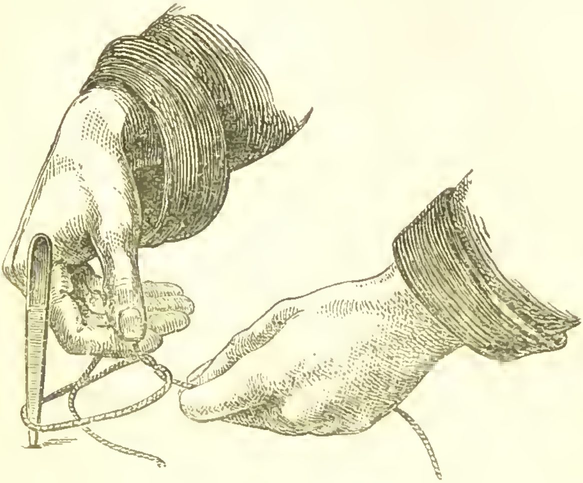


Fig. 14.

In whatever way the knot is made, great care should be exercised not to tie the forceps in, while drawing it close; to avoid which accident, the best way is to keep the loop flat upon the wounded surface, and, as it is drawn tight, to prevent it slipping up with the forefinger on each side. In pulling the ends of the thread they should be drawn *downwards* as much as possible, *i.e.* towards the wound, since otherwise the ligature may very possibly be pulled off repeatedly. Although the manner in which the ligature is tied is of the greatest importance, still much depends upon the way in which the forceps seize the vessel and hold it afterwards. Except in the case of the large vessels which have a distinct sheath, it is impracticable to attempt to seize merely the bleeding orifice, but a certain amount of surrounding tissue must necessarily be grasped, and tied in by the ligature; and it will much facilitate the operation of tying if the holder of the forceps draws it slightly away from the side on which the knots are being made, at the time the ligature is being applied. When the

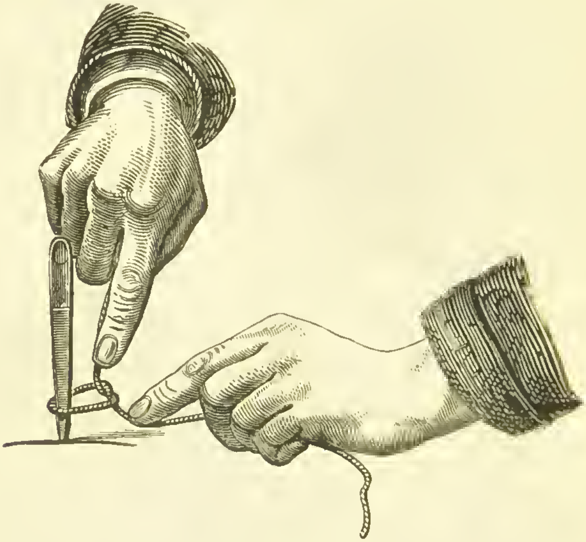


Fig. 15.

tenaculum is used to seize the vessel, the same method of applying the ligature should be employed, but care must be taken to make the knots beneath the instrument, and not over it so as to prevent its being withdrawn.

Silk ligatures should be of hard China twist, and be rendered aseptic by soaking the reel in 1–20 carbolic solution before the operation. Fig. 16 shows a very convenient portable water-tight ligature box of Dr. Aleock. The trough is made of earthenware, and fitted with three reels of the same material. The cover is a glass plate fitted with an india-rubber border on the under surface, and is clamped down with the screws. The ligatures can be drawn out between the rubber and the edge of the trough without leakage.

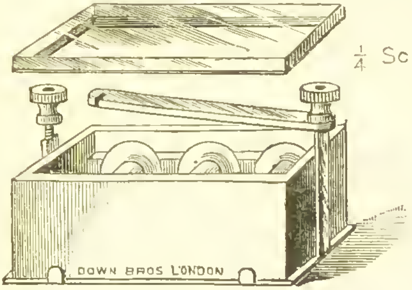


FIG. 16.

The following are the directions for preparing silk ligatures given by Mr. A. E. Barker :—Take strips of clean deal wood 8 inches long, $\frac{3}{4}$ inch broad, $\frac{1}{8}$ inch thick. On these wind the silk *wet* with carbolic solution lengthwise and not too tight, until about fifty lengths are around the wooden strips. Put a tie of the silk round the top and bottom of the latter to keep the silk close to them after it is cut. Then place the strips in ten-inch test tubes, and fill the latter with solution of absolute phenol 1 to 20 of water. Place these tubes in a deep can of water and boil the latter for an hour. This necessarily boils the carbolic solution in the tubes, which should have a plug of salicylic wool in their mouths during this time. Take each strip out of the carbolic solution in the tubes with a clean forceps, and cut all the ligatures across at the lower end with a perfectly clean pair of scissors on both sides of the strip, so as to leave no curl on the silk threads. Then drop the strips back into the tubes still full of hot carbolic solution, with the cut end of the silk downwards. To use such ligatures, take the cotton plug out of the tube and pick out a ligature with a clean forceps. It will come out sixteen inches long, of course, and quite straight without disturbing the rest of the ligatures. These latter can be left in the carbolic solution for any length of time without injury, and are always sterile. An india-rubber stopper may be kept in the mouth of each tube to prevent evaporation and for carriage.

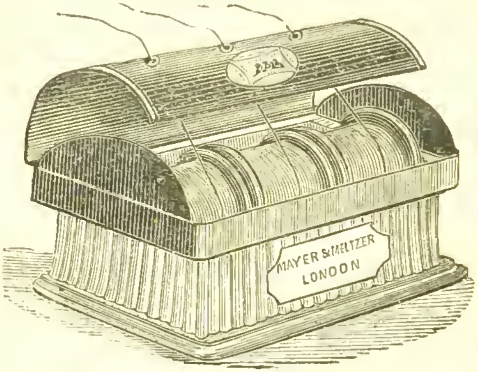


FIG. 17.

The catgut ligatures are made of three sizes, No. 1 being the smallest. The carbolised catgut should be kept in carbolic oil, stoppered bottles being better than those with corks for holding the ligatures ; but for an operating theatre reels should be provided, which can rotate in a trough of carbolic oil (fig. 17).

The following plan for preparing catgut is said to be satisfactory. The catgut is first soaked in ether for twenty-four hours to remove all fat. It is then placed in the following solution :—

Corrosive Sublimate, 10 parts.
Absolute Alcohol, 800 ,,
Distilled Water, 200 ,,

This solution is renewed in twenty-four hours and again in forty-eight hours, and the gut is then placed in alcohol—absolute if a very stiff material is required, or diluted with 20 per cent. of glycerine if a softer form is wanted. It can be kept in these solutions in stoppered bottles, or in special bottles provided with reels.

Chromicised catgut ligature may be kept dry on an ordinary reel, but should be soaked in carbolic lotion for half an hour before being used.

Silkworm gut is a very good material for surface sutures, as it is absolutely non-absorbent. It only requires to be soaked in a warm carbolic solution just before use to make it soft and pliable. It should be kept in a 1–20 solution of carbolic acid.

Horsehair is also useful for superficial wounds where there is no tension. It should be thoroughly washed and be kept in a bottle of carbolic 1–20.

Acupressure, as originally devised by Sir James Simpson, had for its object the arrest of hæmorrhage by means of a harelip pin, which was made to exert pressure upon a bleeding vessel, by compressing it against a bone or the surrounding tissues; but has also been modified by using needles in combination with wires. The pin is to be applied on the surface of the wound, and is to pass over the open mouth of the vessel so as to compress it, or may be made to twist the vessel by being rotated before the point is fixed into the tissues. Wherever it is inserted, the extremity must be left at the surface of the body, in order that it may be withdrawn in from four-and-twenty to sixty hours, after the vessel has become occluded by natural processes. The method with the wires consists in passing a sewing-needle (to the eye of which a wire is affixed) beneath the bleeding vessel, and over its point a loop of iron wire, which passes across the vessel and is secured with a twist around the shaft of the needle. In order to remove this, it is only necessary to untwist the wire, and to withdraw the needle by means of the wire attached to it, when the loop of the secured wire will become disengaged and can be withdrawn. The advantage claimed for these methods is that the irritation caused by a ligature is avoided, the metallic needle producing no such effect ; and being withdrawn at so early a date, it offers no impediment to the wound's healing by first intention. It has been found in practice, however, that the presence of the needles is so inconvenient that their use has not become general

Torsion of arteries is an old practice which has of late been revived and a good deal employed. It consists in grasping the mouth of a cut artery with broad serrated forceps, which have a sliding button or catch, or with a pair of Wells's forceps, by which the vessel is secured whilst it is twisted two or three times by the fingers of the operator : this is termed 'free torsion.' 'Limited torsion,' which is applicable only to large vessels, consists in drawing the vessel out of its sheath with one pair of forceps, whilst with another pair it is grasped transversely about half an inch from the extremity, which latter is then twisted as shown in fig. 18. Another method of applying torsion to large arteries, much employed at Guy's Hospital, is to draw the vessel out with a pair of forceps so as to grasp it *transversely* with a pair of torsion forceps, which are then 'thrown over' from three to six times, according to the size of the vessel, thus effectually twisting it.

The employment of torsion is not so easy as the application of a ligature, as it is necessary to seize the mouth of the vessel fairly and alone in order to obtain

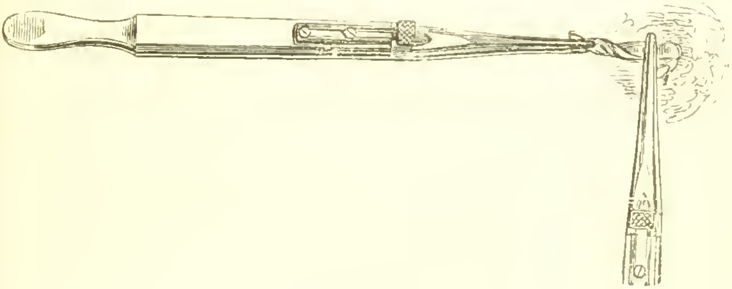


FIG. 18.

a good result. Hence more care and time are required in the operation than in merely picking up vessels with some of the surrounding tissue before the ligature is applied.

CHAPTER II

WOUNDS, CONTUSIONS, BURNS, ETC.

WOUNDS present an endless variety both of shape and position. The treatment of some of these has necessarily been included in the observations upon hæmorrhage, which is one of their constant accompaniments. Respecting wounds generally, it will be sufficient to say that the surgeon's object is to heal them by first intention, if possible, and that this result may be ordinarily looked for in the case of incised wounds, provided they are kept perfectly clean and aseptic, whilst it is least likely to occur in crushed or torn tissues. Dry antiseptic dressings, with moderate pressure and support, have a direct tendency to aid the process of rapid healing, and they form therefore the appropriate treatment of incised wounds. Should any dirt or foreign body have entered the wound, it must be carefully removed with a piece of cotton wool dipped in carbolic lotion ; but if there is no reason to imagine such an event to have occurred, it is cruel and unnecessary to insist upon probing a wound simply to satisfy a morbid curiosity as to its depth, with the possibility of exciting anew the hæmorrhage which has been arrested by natural processes. The wound, having been carefully washed out with carbolic lotion (1–20), is to be squeezed dry and then dusted with iodoform, and if deep is to be drained by the insertion of a suitably sized drainage-tube at the most dependent point. A small pad of gauze will probably be sufficient to keep the edges of the wound in apposition beneath a carefully applied bandage ; but, if not, a pad may be placed on each side of the incision so as to exert pressure on the deeper parts, the surface being covered with a small additional piece.

Strips of adhesive plaster may be applied to hold the edges together, but in that case they should be cut long enough to take a hold upon the skin some inches beyond the actual wound. After the operation for harelip, or in other cases of wound where traction is required, it will be found convenient to use the American rubber-plaster (Seabury and Johnson's), which is unaffected by moisture, and to make the ends of the plaster much wider than the central portion ; or to use two strips of plaster of different widths, passing the narrow one through a transverse slit in the wider one, and splitting the ends of the plaster so as to obtain a good hold on the tissues (fig. 19). Or, if elastic tension is desirable, a common india-rubber ring may be inserted between two pieces of plaster cut and folded, as in fig. 20. In the case of the extremities, it may sometimes be advisable to carry a long strip of plaster round the limb, making the ends cross over the wound in order to exert pressure upon the tissues.

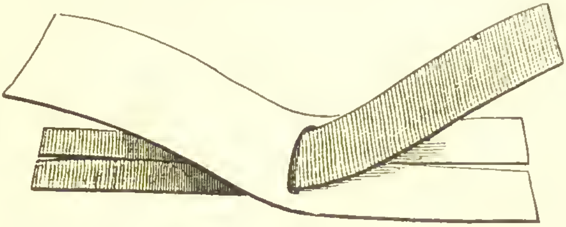


FIG. 19.

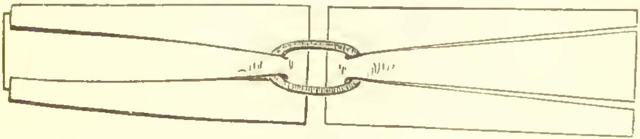


FIG. 20.

Sutures are requisite in large wounds, and in cases where the skin retracts so that without them the cut surfaces do not come into apposition ; they should be of carbolised silk or fine wire, or on the face may be of fine catgut or horsehair, the former of which dissolves away spontaneously. The surgeon's knot (fig. 21) may be conveniently used both for silk and catgut, since the double twist prevents the slipping of the knot, which is apt to take place if the reef-knot is employed where there is any tension.

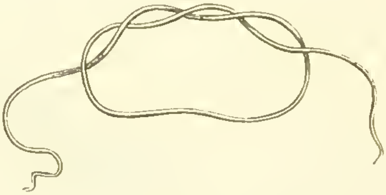


Fig. 21.

In deep wounds, such as wounds of the forearm where tendons are divided, it is not sufficient to close the skin alone, but the ends of the tendons must be carefully sutured together with catgut, and especial care must be taken not to overlook a divided median or ulnar nerve, the ends of which should be brought together in the same way.

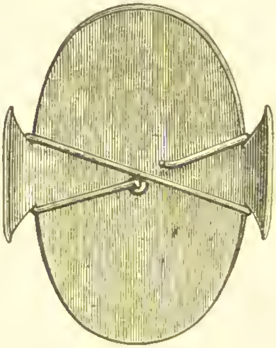


Fig. 22.

In large wounds, where the removal of skin makes the approximation of the surfaces difficult (*e.g.* after amputation of the breast), sutures of thick wire may be conveniently inserted half an inch from each edge, so as to take off all tension upon the finer stitches. With the same object lead plates or buttons (fig. 22) may be employed, to which the deep sutures can be conveniently attached.

In all wounds not likely to heal by first intention, drainage must be secured for the discharges, which are certain to form in whatever way the wound is treated. This may be done by simply leaving the lower end of the wound open ; or better, by inserting a piece of carbolised india-rubber drainage-tube of a size suited to the case, or a few strands of catgut ligature or horsehair.

Contused and lacerated wounds, particularly those in which a large portion of skin has been destroyed, can only be expected to heal by granulation, and they may therefore be appropriately treated from the first with antiseptic dressings. It is in these wounds that foreign bodies may generally be expected, and care should therefore be taken to cleanse them as far as can be readily effected ; but any little remainder of dirt, &c., will be certainly thrown off by the process of suppuration. Strapping and careful but light bandaging are very serviceable in these injuries ; but sutures are of little use unless the wound is very extensive. In fact, the house-surgeon will have to guard against allowing a wound to heal at the surface while suppuration is going on in the deeper parts.

The after-treatment of wounds consists mainly in attention to three points—viz. rest, cleanliness, and temperate living. The first must be attained by confinement to bed in severe cases, or at least cessation from employment, and if necessary the use of a sling, &c.; the second is for the house-surgeon to see to at each dressing of the wound ; while the third can generally only be hoped for in patients under the surgeon's eye in the wards of a hospital.

Cases in which union by first intention is hoped for should not have the first dressings disturbed before the third or fourth day, provided there is no pain or throbbing complained of, and the dressing should be soaked off with tepid carbolic water, to avoid tearing open the edges of the wound. Should the edges be found united throughout, and no swelling or redness indicate the presence of pent-up matter, a piece of dry lint and a bandage should be again applied to give support, and in a few days a perfect cure will be effected. It not unfrequently happens, however, that pain and throbbing indicate the presence of pent-up fluid, and it is surprising how much inconvenience a mere bead of matter will occasion. In such a case it is unnecessary to tear open the whole of the wound; for if with a probe a small opening be made at one end of it, a little pressure will cause the fluid to exude, to the patient's immediate relief, and the lint and bandage can then be readapted. Supposing the effort to induce healing by first intention to fail, the wound will become converted into a granulating one, and be treated accordingly.

Granulating wounds are best treated with water-dressing, some stimulating lotion being used in addition when necessary. When there are sloughs to come away, linseed-meal poultices sprinkled with iodoform may be advisable for a time, but when possible they should be removed with scissors, under an anæsthetic if necessary. In dressing a granulating sore, care should be taken to cut a piece of lint just the size of the wound; over that should be placed a piece half an inch larger in each direction, and on that again the oil-silk or thin gutta-percha, which should again slightly overlap it, the whole being retained by strips of plaster or a light bandage. Although cleanliness, as regards the dressings, &c, is of the greatest moment, the surface of the sore should not be interfered with more than to sponge off, gently, any superfluous matter, for a certain amount of discharge is always produced by the granulations.

Wound of the cornea is too frequently accompanied by prolapse of the iris. In penetrating wounds of the eyeball the danger to be guarded against is the introduction of septic material into the interior, leading to plastic or purulent inflammation of the iris, with the consequent dangers of panophthalmitis and sympathetic ophthalmia. The eyeball and conjunctival sac should at once be thoroughly washed out with boracic lotion, or a solution of perchloride of mercury (1–5000). If a very small prolapse of the iris have occurred and the case be seen soon, it may be replaced in the eye. Eserine should be instilled if the wound be marginal, and atropine if it be central; but this is not sufficient to quite free the wound of iris, and the prolapse should therefore be replaced with a fine probe.

In the majority of cases the prolapsed iris must be cut off, and this should be done at once to avoid adhesion of the iris to the wound. Cocaine having been instilled, the iris should be drawn out a little further with fine forceps, and snipped off close to the wound with scissors. The wound must then be carefully freed of iris and atropine dropped in, by which means the danger of iritis is reduced. A wound of the sclerotic is always more serious than one of the cornea, and may immediately destroy sight. When the wound is small, an attempt should be made to bring about healing by drawing the edges together with a fine silk stitch. In all cases of wound the eye should be covered with a pad of antiseptic wool, and washed out with boracic lotion twice a day for a week.

Wounds over the shin often give trouble, if neglected. Collodion and absolute rest form the best treatment; and as they are frequently accompanied by a bruise of the surrounding parts, the tincture of *arnica* may be usefully painted around, but not upon, the wound. Curtis's 'Pasma,' or the oxide of zinc powder, may be advantageously dusted on these wounds, or the *Papier Fayard* applied.

Wounds of joints.—Wounds of joints, if not obvious at first, are soon made evident by the escape of synovial fluid which trickles out, and can easily be distinguished from blood by its light colour and tenacity. Unless antiseptic treatment is available, closure of the wound is of the first importance, provided no foreign body be left in the synovial cavity. In the case of punctures or small incisions collodion forms the best application, the same precautions being used as in cuts on the face. (See p. 15.) In the absence of collodion, white of egg is not a bad application; and plaster should be used to support the parts, and prevent the wound being dragged open. When the wound is so large as to require the application of stitches, care should be taken not to insert them through the synovial membrane, and collodion may be advantageously applied over them. Perfect rest and the application of cold are the best preservatives against inflammation of the joint; and a splint should therefore be applied to the limb, which must be kept, if possible, in an elevated position. The posture which is easiest, and which relaxes all the parts most, must be the best at first; but, should inflammation come on, care must be taken to place the limb in a position in which it may be ultimately useful, should the motion in the joint be lost or impaired. The application of an india-rubber ice-bag and irrigation with iced water are the readiest and most certain methods of applying cold to a wounded joint. In the antiseptic treatment of a wounded joint, it would be necessary to wash out the cavity with a solution of carbolic acid (1 in 40), to insert a drainage-tube through the wound, and to apply the gauze dressing with all the details described under 'Antiseptic Dressings.' A bursa over a joint, when opened, pours out a fluid closely resembling synovia, which might be considered diagnostic of injury to the articulation; but the cautious introduction of a probe would at once decide the question of its origin.

Bruises and contusions form a considerable portion of out-patient practice. They present every possible variety, and it is generally from fear of some more severe lesion having occurred, rather than for the treatment of the bruise itself, that the patient applies to the house-surgeon. A careful examination is essential in all cases of contusion, lest some injury should be overlooked; and when, as sometimes will occur, it is found impossible, owing to the swelling, to arrive at a definite conclusion, it is better to err on the safe side, and treat the case for the more severe injury (*e.g.* fracture), than to commit an error which may be of lasting importance to the patient, by ignoring the possibility of its occurrence.

Cold is the best application for a recent bruise, and this may be applied in any way most convenient —by irrigation, the application of an ice-bag, or the use of an evaporating lotion. The following is a useful formula for an evaporating lotion :—

℞ Spiritûs Vini rectificati,
Liquoris Ammoniæ Acetatis, ãā f℥j;
Aquæ Camphoræ f℥viij. Misce.

and care should be taken to instruct the patient to allow it to *evaporate*, and not to cover the rag on which it is applied. The tincture of arnica has been highly recommended in all cases of bruise, and, when used undiluted, appears to have considerable power both in alleviating pain and inducing absorption of the effused blood. In some persons with irritable skin the pure tincture is apt to produce a form of erysipelas, and it is well, therefore, to be cautious in its employment on the first occasion. The tinctures of Calendula and of Hamamelis (Hazeline) are also useful, and the glycerine of belladonna is found to relieve the pain of a bruise promptly.

There is one form of bruise which requires special notice, and that is, where a circumscribed swelling on the head is produced by a blow, giving an appearance resembling depressed fracture of the skull, owing to the circumferential swelling of the integuments. Since this affection is frequently conjoined with cerebral symptoms—concussion more or less severe—it becomes of importance to make a correct diagnosis; and careful manipulation will generally prove that the appearance of depression is deceptive, while the presence of fluctuation in the centre will, in many cases, assist in arriving at the truth. A bladder or, better, a flat-bottomed india-rubber bag of ice to the head is the best treatment. In large subcutaneous effusions of blood in a limb, it may be occasionally advisable to tap the swelling with a fine aspirator-needle, and draw off the uncoagulated blood; but this should never be done in a recent case, as it will only lead to further effusion from the ruptured capillaries.

The possibility of the occurrence of acute necrosis of a long bone, and especially the tibia, in a child after a comparatively slight injury is always to be borne in mind; and the rapidly formed inflammatory swelling must not be confounded with the effects of a bruise, nor, on the other hand, with the mottled skin due to *erythema nodosum*, which last usually affects both legs. The thermometer will at once denote the presence of acute inflammation, and a prompt incision down to the bone will give immediate relief.

Contusions are best treated by rest and opiate applications. Bed is the great panacea; but if this is not attainable, rest of the limb, by means of a sling or otherwise, should be enjoined. In contusions of the chest, even where there is no suspicion of a broken rib, a broad flannel bandage, firmly applied, gives great relief by restraining the intercostal muscles; and on the same principle a bandage may be applied to a limb. Soap liniment with a little laudanum in it is a good application in most cases; or the belladonna liniment (B.P.), sprinkled upon lint and covered with oil-silk, will be found useful.

When a patient is shaken and bruised all over by a fall from a horse, or otherwise, a warm bath gives great relief, provided he is not faint.

In any case of contusion about the abdomen, and particularly if the injury has been inflicted by a carriage-wheel, the house-surgeon should immediately pass a catheter, which must be retained if there are symptoms of injury to the bladder or to the urethra, such as bloody urine, or pain over the pubes. The early attendance of the surgeon should be requested to any case in which rupture of the bladder may be suspected, and care should be taken in these cases not to overlook a fracture of the pelvis without displacement.

Blood under the nail is a not uncommon result of a contusion of the finger, and is excessively painful from the pressure upon the sensitive matrix. With a fine sharp knife or needle the cuticle overlapping the base of the nail may be gently lifted until the blood is reached, when it can be sucked out; or if the blood is under the middle of the nail, it must be cautiously scraped through with the same object.

Sprains, though apparently trivial, should never be neglected, since they too frequently lead to joint-disease. Although, in most cases, it is only the ligamentous tissues which suffer, yet occasionally small prominences of bone are wrenched off, or, in youth, the epiphyses may be torn away. In all cases of sprain, therefore, a thorough but gentle examination of the joint should be made, and if this is impossible from the pain produced, chloroform should be had recourse to, rather than that an error in diagnosis should be committed. A sprained wrist or ankle has often been diagnosed in cases of Colles's and Pott's fracture, for unless seen immediately, the swelling is often so great as to mask the nature of the case, and no opinion therefore should be pronounced until a thorough examination can be made.

The local abstraction of blood by leeches is of great benefit in violent sprains, and the bleeding may be encouraged by hot baths or the application of linseed poultices. Subsequently, support of the affected joint is of the greatest importance, and this may be effected by careful bandaging, or, still better, by strapping with adhesive plaster, which has the advantage not only of supporting, but of rendering the joint motionless, much more effectually than the bandage. Strapping may, in most cases, be applied within thirty-six hours of the injury, and thus the patient will be enabled to get about with comparative comfort. Stimulating frictions are useful in the later stages.

Strains generally mean some rupture of muscular or tendinous fibres, although sometimes the term is vulgarly applied to a hernia. Time is the only cure for ruptured tissues, and all the aid the surgeon can give is to approximate the extremities of the torn fibres, and support them by a bandage, so that they may unite as rapidly as possible, and also that no subsequent weakness may result from the tissues being lengthened. Cold applications will be useful in relieving the pain, and will assist in inducing the absorption of any effused blood.

‘Rider's sprain’ implies the rupture of some of the fibres of the adductor muscles of the thigh, leading to considerable effusion of blood and bruising, and inability to grip the saddle with the knees. It is best treated by an elastic support, kept in place by a waistband, to which it is attached by straps.

'Lawn-tennis elbow' is a painful condition due to strain or rupture of the supinator brevis muscle in giving a back-stroke. Support with straps of plaster is the best remedy. The weakness of wrist caused by stretching of the annular ligament is best met by habitually wearing a strap round the wrist when using it freely.

Ruptured tendo Achillis may be conveniently mentioned here. It generally results from some unwonted exercise on the part of an elderly person, who drops suddenly to the ground. A snap is sometimes heard, and the rupture can be felt with the finger. The treatment consists in attaching a strap to the heel of a slipper, and fastening it above the knee, so as to point the toe thoroughly and slightly flex the knee. 'Lawn-tennis leg' is a rupture of the fibres of the muscles of the calf, and may be treated in the same manner or by raising the heel of the boot, and by wearing an elastic stocking.

Machinery accidents present every variety, from simple fractures or incised wounds to total disorganisation of a limb. The hæmorrhage, if any, should be arrested, and the parts be brought as nearly as possible into their normal relations to one another, stitches being inserted when necessary; and even where there is no fracture, the application of a splint to a crushed limb will often be of the greatest service. Amputation should not be thought of while there is any hope of saving a limb, since it is extraordinary how well severe machinery accidents turn out, owing to the previous good health of the patients. When a portion of a limb has been torn off, amputation higher up will probably be necessary in order to obtain sufficient soft tissue to form a stump; but for this the advice of the visiting surgeon should always be obtained.

Extraordinary scalp wounds are sometimes produced by the long hair of women becoming entangled in machinery, and the scalp being consequently torn off the head, partially or completely. If only partially removed, the scalp should be carefully sponged and replaced, with fine carbolised stitches and with dry antiseptic dressings. The 'capeline' bandage (Chap. VIII.) will be found a very useful application in these cases, and will often insure healing by first intention. When the whole scalp has been torn off, water dressing forms the best application, and the surface will proceed to granulate, provided the patient's strength is sufficient to bear up against the shock and exhaustion.

The house-surgeon may be summoned to a manufactory to 'cut out' a sufferer from machinery, which it is found impossible to remove without doing further damage. No precise rules can be laid down for such proceedings, but the chief points are, to guard against hæmorrhage, and to remove as little of the body as possible ; but the amputation should be done so as to avoid a second operation.

When a limb, and particularly the arm and hand, has been crushed by machinery, and it is resolved to give it a chance of recovery, a most excellent mode of treatment will be found in irrigation with tepid carbolised water. The constant flow of water keeps the complicated wound thoroughly clean, modifies the inflammation, and has a direct tendency to effect a cure. When granulation has commenced, the ordinary treatment of wounds is all that is required—viz., cleanliness, support, and slightly stimulating lotions, together with proper attention to the patient's general health.

Burns and Scalds.—In severe cases, the constitutional treatment is of more immediate importance than the application of local remedies. The patient is suffering from 'shock' in its most aggravated form, and is to be treated accordingly. He should be wrapped in a warm blanket and placed near a fire, whilst some warm brandy and water is administered. When the warmth of the body is thoroughly restored, attention may be directed to the local injury, and dressings may be applied to one limb at a time, the rest of the body being carefully covered up. In the case of burns of the trunk in children (and in adults, too, if conveniences are at hand) immersion in a warm boracic bath (90° F.), the temperature of which must be carefully maintained, will ease the pain and float off the charred remnants of the clothes, leaving clean surfaces for the application of dressings. If the 'continuous bath' can be employed, the patient may with advantage remain in it until cicatrisation is complete.

In superficial burns (*i.e.* where only the cuticle is destroyed) and in scalds, a ready domestic application is common treacle or flour from a dredger; or a mixture of collodion and castor oil (two parts to one) may be painted with a small brush all over the injured surface; or a solution of nitrate of silver (fifteen grains to the ounce) may be painted over the whole surface, thus producing a protecting eschar; or a saturated solution of bicarbonate of soda may be employed.

When vesicles have been produced, they should be snipped with a sharp pair of scissors, the serum being gently evacuated with a piece of cotton-wool, and the nitrate of silver lotion or the collodion mixture applied over them. This mixture may be conveniently kept ready made in a well-stoppered (or better, a capped) bottle, in the surgery, and its application, although painful for the moment, will be found to give immediate relief to the smart of the injury. No other dressing should be put over the collodion, which should be repeated once or twice as it dries. If the injury is quite superficial, the skin will probably cicatrise before the scab drops off; but if too severe for that, healthy granulations will spring up, which are best treated with antiseptic dressing. Cotton-wool (or, what is better and cheaper, the common white cotton-wadding split open) is a favourite and useful application both for burns and scalds. It should be carefully wrapped around the injured part, and maintained in position by bandages. It certainly soothes the pain rapidly, but has the disadvantage of sticking to the raw surface, from which it should be allowed to separate by suppuration, assisted by a poultice if necessary.

Carron oil (equal parts of lime water and linseed oil—linimentum calcis) is an exceedingly nasty application, though a favourite with many surgeons. Carbolic oil (1 in 10) is a better application, and lint soaked in it may be placed over the burnt part, and in badly charred cases it is perhaps as good an application as any. The boracic acid ointment has the advantage of combining an antiseptic with a greasy dressing, and is largely employed in University College Hospital. It should be covered with absorbent wool, preferably salicylic wool, when there is much discharge. At the London Hospital, where the cases of burns are very numerous, the universal treatment is the application of zinc ointment on lint, fomentations being applied over the dressings for the first few hours.

Mr. D'Arcy Power speaks highly of a solution of picric acid as an application to superficial burns and scalds. The solution is made by dissolving a drachm and a half of picric acid in three ounces of alcohol, to which two pints of distilled water are added. Strips of sterilised gauze are soaked in the lotion and applied, and a thin layer of absorbent wool is kept on with a bandage for three or four days, when the dressing must be carefully soaked off with the lotion and renewed at longer intervals.—(*B. M. J.* 12 Sept. 1896.)

The after-treatment of burns, both local and constitutional, is of the greatest importance. If the injury be at all severe, hot bottles should be applied to the feet, and some form of sedative, even in young children, will be advisable, both to relieve pain and procure sleep, and this may be necessary for some days after the accident. In very extensive burns, it will be advisable to administer chloroform for the first few dressings, and then to give a hypodermic injection of morphia so as to prolong the sedative effect. Subsequently, ample nourishment, and probably stimulants, will be necessary to counterbalance the drain upon the system caused by the profuse suppuration. As respects the wound itself, our object is to get it into a state of healthy granulation as quickly as possible; and for this purpose—so soon as the first applications are removed—water dressing may be applied, with or without myrrh or some other lotion; or the zinc ointment may be used, if preferred. When a highly sensitive surface, such as the face, has been extensively burned, the ointment should be preferred, as it adheres less to the surface. In these cases the dressing should be changed as seldom as may be, and if possible under chloroform.

To prevent contraction during and after the cicatrisation of burns is one of the house-surgeon's most difficult tasks, and will tax his ingenuity to the utmost. Extension of the cicatrix must be constantly kept up by the use of splints if the injury is on the limbs, or by laying the patient flat in bed, or even with the head overhanging the bedstead, if the burn is on the neck. In these cases strips of plaster may be most usefully employed to stretch the cicatrix, and if the patient's head is shaved, the scalp will be found to afford a firm attachment for them. Of the various mechanical apparatuses which have been contrived for stretching the cicatrices of the neck, the only one which is really effective is that which exerts pressure in both directions, and pulls the skin down over the clavicles by means of a collar, at the same time that the chin is raised. Those screws which only get their purchase from a waistband, and therefore only act in one direction, are worse than useless.

Bad burns are often months in a hospital, and as they are by no means favourite cases with either dressers or nurses, it behoves the house-surgeon to exercise a sharp surveillance, and to see that they are properly attended to, or he will find that with all his care the patient will become crippled by contractions.

Scalds of the glottis require special notice and treatment. The patient is generally a child, who has attempted to drink boiling water from the spout of a tea-kettle, and has consequently injured the mouth, fauces, and upper part of larynx, more or less severely. The symptoms of dyspnœa will vary according to the time which has elapsed since the accident, and the amount of damage done. If the little patient is evidently *in articulo* from want of breath, the house-surgeon had better do laryngo-tracheotomy at once; but if the symptoms are not of such extreme urgency, the operation should be deferred, for a time at least, in order to try the effects of treatment. The first thing is to place the patient in a warm and moist atmosphere, by placing an ordinary surgical cradle over him and under the bed-clothes or a piece of mackintosh cloth, and then bringing the steam of a kettle beneath the canopy thus formed. Care must of course be taken that the temperature be not raised above 80°, or the patient will be suffocated and parboiled. Relief may also be attempted by scarifying the back of the throat, epiglottis, &c., which has been known to be of great service in some cases.

As regards medicines, antimony and ipecacuanha appear to offer the best chance of success, and they may be most conveniently administered in the form of the wines. Large doses of either (and antimony by preference), according to the child's age, may be given, and frequently repeated, until the breathing is relieved. Vomiting is not to be wished for, and will seldom be produced. Mercury may be combined with the antimony, and to be of any service must be administered in heroic doses and frequently ; but should the breathing become more embarrassed, the operation of laryngotomy or tracheotomy must at once be had recourse to.

Injuries from fire-arms and gunpowder.—Gunpowder will inflict damage according to the mode in which it is exploded, rather than the actual quantity ignited. Loose powder scorches and burns the surface of the body severely, and, from the mode in which it 'flares up,' is very apt to injure the eyes and burn the hair off the head, besides driving particles of unburnt powder into the skin. These, if left, will give a very unsightly blue appearance to the patient, and it is worth while to spend some time in picking out the powder grains with a needle, while the injury is recent. In order to do this effectually, however, it will be necessary to put the patient under chloroform. The treatment of such injuries differs in no essential particulars from that of burns generally. Compressed powder shatters and destroys by the force of the explosion, in addition to the damage done by the flame. A firework exploding in the hand, the bursting of a gun, or, still more commonly, of a powder-flask held over a light, will shatter the hand very severely. On admission to the hospital, the hæmorrhage, if still existing, should be arrested by ligature or otherwise, and the state of the hand be carefully examined. In the case of children or adults without much self-control, it may be advisable to administer chloroform at once, and to do what is necessary while the patient is under the influence of the anæsthetic. If fingers are blown off, the adjacent tissues should be drawn together as far as may be, to form a stump ; or it may be well, particularly in the case of patients of the better class, to remove at once the head of a metacarpal bone, so as to improve the after-appearance of the hand. Although severely torn and even fractured, a finger should never be hastily amputated, since, with careful dressing and support on a splint, apparently desperate cases do well eventually. If only *one* finger can be preserved it should be saved; and what is said of a finger applies with double force to the thumb, without which the hand loses the greater part of its powers, and presents a most unsightly appearance.

Gunshot injuries may be immediately fatal from hæmorrhage, or from injury inflicted on a vital part. A bullet and a charge of shot at a short distance will each produce a single wound, the edges of which are inverted; whereas if the missile emerge from the body, the edges of the last opening are, as a rule, everted. A charge of shot from a distance is so much scattered as to do little more than 'pepper' the patient, the pellets lodging in the skin, from which they are readily extracted; but if fired pretty close the charge does more harm than a bullet, tearing the soft tissues and spreading through them so as to render extraction of the shot impossible. Even 'blank cartridge,' if fired within a few yards, may inflict serious injury; the wad striking and bruising the face, or even rupturing the eyeball, and the grains of unburnt powder being lodged in the skin. These should be extracted at once as far as possible with the point of a needle, or an indelible blue mark will be left on the part affected.

The primary treatment of gunshot wounds does not differ in any way from that of wounds generally; but as in the after-treatment, the extraction of the ball, &c., many important questions become involved, it will be well for the house-surgeon to obtain the advice of the visiting surgeon at an early date, more particularly since gunshot injuries almost always lead to legal inquiries in some form or other. When the presence or position of a bullet is uncertain, recourse may be had with advantage to the Röntgen rays.

The treatment of wound of the lung by firearms is the same as in the case of stabs. (See p. 20.)

Bites of animals and stings.—The dog is the animal whose bite is most commonly met with, though occasionally the cat, rat, or horse inflicts injury in this way. The fear of hydrophobia is always present in the mind of a patient who has been bitten, and the house-surgeon should not lose sight of the danger, although the frequency of its occurrence is greatly exaggerated. When, as often happens, the dog has merely snapped, and perhaps grazed or only marked the skin, no treatment is really required, though it may be advisable to give the patient some evaporating lotion as a *placebo*, together with a few words of assurance as to his safety. Where a wound is actually inflicted, if recent it may be cauterised with nitrate of silver; or, if there are really any suspicions as to the state of the animal, it will be only safe to give the patient chloroform and excise the edges of the wound, taking care to go quite to the bottom, or, where this is impossible, the actual cautery will form an efficient substitute. Both patient and animal should be kept under surveillance for some weeks, if possible, in order that any symptoms may be treated as early as may be. The bite of a cat is even more dangerous than that of a dog; but that of a horse is only important on account of the severe local injury generally inflicted when this animal indulges his biting propensities.

The bite of the adder is the only common accident of the kind met with in this country. The treatment consists in tying a ligature tightly round the limb above the wound, in order to prevent absorption of the poison, and subsequently in the extraction of the poison by sucking the wound or applying cupping-glasses, after which a poultice is the best application. The vital powers are severely and rapidly depressed by the absorption of the poison, and must be supported by the free administration of ammonia, ether, brandy, &c. In the rare cases in this country of bites by tropical serpents, the rapid administration of diffusible stimulants and the use of artificial respiration form the appropriate treatment. The pain of the stings of insects is best relieved by belladonna.

Suspended animation (hanging, drowning, &c.)—Drowning is the most common cause of suspended animation, though cases of hanging and suffocation from noxious gases occasionally occur. In all cases the object is the same—viz. to restore the action of the heart, which may be most readily accomplished by resorting to artificial respiration, combined with friction to the trunk and extremities. The Marshall Hall method of artificial respiration, as it is called, consists in laying the patient on his face with his right arm doubled under the forehead, so as to prevent obstruction of the mouth, which should be seen to be open. The assistants, grasping the left shoulder and hip, should then turn the patient on his side and

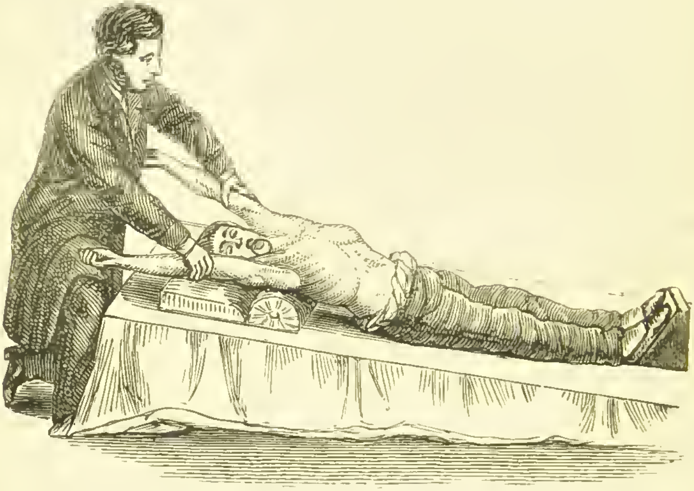


Fig. 23.

halfway on to his back, when the motion is to be reversed, and the patient placed again in the prone position. This series of manœuvres should be repeated from sixteen to twenty times a minute, and the difficulty in practice is to prevent the too rapid movements of over-zealous assistants.

Another and more effectual method (Dr. Sylvester's) is as follows :—The mouth being cleared of any dirt or saliva which may be in it, the tongue should be drawn forward and held with the finger and thumb or a pair of forceps, or secured with a piece of ribbon or an elastic band passed over the tongue and under the chin. This drawing forward of the tongue is very important, as it opens the windpipe, and must never, therefore, be omitted. The patient being laid on his back, with the shoulders and head slightly raised, the operator then kneels behind his head, grasps the arms just above the elbows, and draws them steadily and gently upwards (fig. 23) until they meet above the head. By this means the ribs are elevated by the pectoral muscles, and inspiration is produced. The

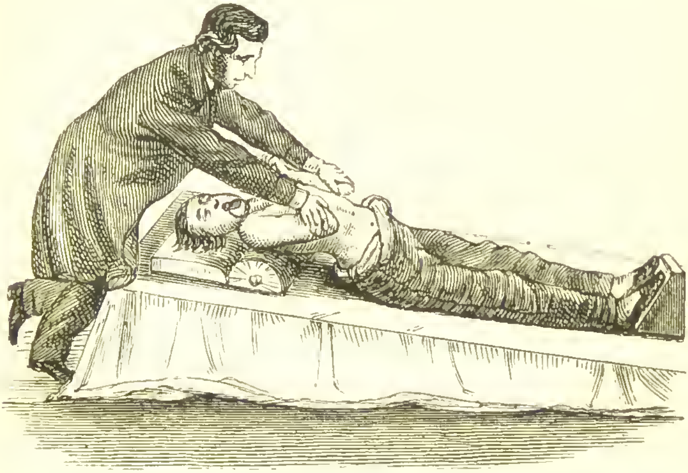


Fig. 24.

arms are then to be brought down to the side of the chest, which they are to compress in a slight degree (fig. 24) so as to imitate expiration. These movements are to be repeated as slowly as in the other method, and they give a more complete change of air to the lungs.

Dr. Howard of New York has introduced a third method, which in his large experience of the treatment of drowned persons has given most satisfactory results. He lays great stress upon emptying the stomach of its contents, so as to free the diaphragm from pressure ; and for this purpose places the patient face downwards on a firm roll of clothing, so that the head may be lower than the trunk. Forcible pressure upon the back being then made, the contents of the stomach are readily ejected. The patient is then to be turned quickly on his back, the roll of clothing being so placed beneath him as to make the breastbone the highest part of the body. If an assistant is at hand, the tongue is to be seized with a piece of rag and drawn out at one corner of the mouth, and the arms of the patient are to be drawn well above his head and held there crossed ; but this is not essential. The operator then kneels astride the patient, and, fitting the fingers of both hands into the lower intercostal spaces of each side, forcibly compresses the lower ribs by bowing forward over the patient's body. In this way expiration is produced by acting on the most mobile portion of the thorax ; and the elastic recoil of the ribs, upon the operator loosing his hold, is sufficient to produce inspiration.

Whichever method is preferred should be put in force without a moment's delay, and be persevered in without intermission for not less than half an hour. Friction with warm towels may be had recourse to in addition, the direction of the rubbing being as far as possible *towards* the heart.

The galvanic battery, or the more convenient electro-magnetic machine, may be had recourse to in desperate cases, but is rarely of much service. The poles may be applied over the base and apex of the heart, or better, over the phrenic nerve at the root of the neck and over the diaphragm ; but the artificial respiration must never be relaxed, as upon it the chief reliance is to be placed (*vide* chapter on Anæsthetics).

In cases of hanging, and occasionally of drowning, the face is turgid and the head evidently enormously congested ; and under these circumstances it will be justifiable to take blood from the external jugular vein or from the temporal artery.

When symptoms of recovery begin to show themselves, stimulating enemata of wine or brandy may be useful; but the house-surgeon must be careful not to administer stimulants by the mouth until animation is fully restored, lest they pass into the lungs and so suffocate the patient. In cases of apparent death from chloroform, carbonic acid, &c., all the above measures may be adopted : and in addition (particularly in the case of chloroform), dashing with cold water, to produce a forcible inspiration, should be immediately had recourse to.

Concussion and compression.—When a patient is brought into the hospital in an insensible state, the result of a blow on the head, it becomes of immediate importance to determine the cause of that condition. The house-surgeon should make a careful examination of the head to see if there is any external injury, and institute inquiries as to the nature of the blow and its probable seat. If there is no injury to the head, or at most only a scalp wound, if the patient can be partially roused by bawling at him, and if his skin is cool and the pupils react to light, he may pretty safely be considered to be labouring under concussion. If, on the contrary, he is perfectly senseless, if the breathing is laboured and stertorous, and the pupils are unequal or dilated, it may be looked upon as a case of compression. The diagnosis will be confirmed by any severe external damage to the head, and particularly by any fracture or depression of the skull. The pulse will not be of much service as a diagnostic aid *immediately* after the accident; but in a few hours will vary materially in the two affections—in concussion being feeble and irregular, in compression becoming full and slow. It must be carefully borne in mind that cases of apparently simple concussion may become converted, at any moment, into examples of compression, the result of intracranial hæmorrhage, and this will be generally indicated by the supervention of stertorous breathing.

The primary treatment of both affections is the same : viz. to place the patient in bed, have the head shaved, and insure perfect quiet by the exclusion of all visitors. In concussion, if the depression of system is not already too great, cold may be applied to the head in the form of evaporating lotions or a bladder of ice; but if the patient is very prostrate these should be omitted, and hot bottles be applied to the feet and mustard poultices to the calves of the legs. A patient may lie for hours in a perfectly tranquil condition, and so long as his pulse keeps steady and the breathing regular, this need excite no alarm; but should the pulse decline, or symptoms of compression from effused blood come on, the advice of the visiting surgeon must be obtained without delay.

In cases of compression, the visiting surgeon should be immediately summoned, since operative proceedings, to be of any service, must be had recourse to at as early a period as possible, and even should none be advisable, the treatment of these cases requires all the suggestions of long experience.

Comparative Table of Symptoms of Concussion and Compression of the Brain (from Gross).

Concussion.	*Compression.*
1. The symptoms are immediate, coming on instantly after the infliction of the injury.	1. An interval of a few minutes, or even of a quarter of an hour, sometimes elapses if the compression is caused by extravasation of blood.

Concussion.	*Compression.*
2. The patient is able to answer questions, though with difficulty, and usually only in monosyllables, such as Yes or No.	2. The power of speech is totally abolished; we may halloo in the patient's ear as loudly as possible, and yet there will be no response.
3. Special sensation is still going on, the patient being able to hear, see, smell, taste, and feel.	3. Special sensation is destroyed.
4. The respiration is feeble, imperfect, and noiseless.	4. The respiration is slow, laboured, stertorous, and performed with a peculiar blowing sound.
5. The pulse is weak, tremulous, intermittent, and preternaturally frequent.	5. The pulse is laboured, soft, irregular, and unnaturally slow, often beating not more than 50, 55, or 60 strokes in a minute.
6. There is nausea, and sometimes vomiting.	6. The stomach is quiet and insensible to ordinary impressions, even to emetics.
7. The bowels are relaxed, and there are sometimes involuntary evacuations.	7. The bowels are torpid, and are with difficulty excited by the action of purgatives.
8. The power of deglutition is impaired, but not abolished.	8. Deglutition is impossible, and sometimes does not return for several days.
9. The bladder retains the power of expelling its contents, but sometimes, owing to the weakness of its sphincter, the water flows off involuntarily.	9. The bladder is paralysed, and therefore incapable of relieving itself, the surgeon being obliged to use the catheter.
10. The voluntary muscles, although much weakened, are still able to contract, there being no paralysis.	10. There is often paralysis on one side of the body, generally opposite to that of the compressing cause.
11. The pupils are usually contracted and somewhat sensible to light; the lids are open and movable.	11. The pupils are widely dilated and unaffected by light, the lids being closed and immovable.
12. In concussion, the mind is in a state of abeyance; it is weak and confused, but not abolished.	12. In compression, the mind is absent, and the patient is comatose.

FOREIGN BODIES.

In the eye.—Foreign bodies lodged on the conjunctiva may vary from a small particle of dust to a splash of molten lead sufficient to cover the cornea. Immediate removal is absolutely necessary in all cases.

and this is accomplished by everting the lids over a probe, when the foreign body may be removed with a pair of forceps, or brushed out with a camel's-hair pencil. When a particle of metal or some similar foreign body has become embedded in the cornea, it may be difficult to catch sight of it; and the house-surgeon should place the patient between himself and the light, and look *along* the cornea, when, even if the foreign body does not project, he will be able to mark the abrasion of the epithelium, and very probably catch the refracted image of the object. The little 'spud' made for the purpose, or a broad needle, will be required to dig the foreign body out of the cornea, and when this has been accomplished, a drop of castor oil placed between the lids will give immediate relief to the pain. When a particle of metal has been removed, or has possibly worked its way out spontaneously, there will often be left a slight stain, which will not require any special treatment. The magnifying-glass will serve to establish its nature.

In many cases, particularly in children, the spasm of the eyelids is so great that it is impossible to examine the eye, much less to remove a foreign body; and it is advisable, therefore, to instil a few drops of a 5-per-cent. solution of Hydrochlorate of Cocaine or to have recourse to chloroform, by which means the difficulty is immediately overcome.

Lime in the eye produces most serious mischief unless immediately removed. This should be done with a *dry* camel's-hair brush, and then the eye should be thoroughly washed with vinegar and water, or very dilute acetic acid, so that any remaining lime may be converted into a harmless salt. It is well to warn the patient and friends that the injury is of a serious nature, so that they may be prepared for the opacities which will probably be left, notwithstanding early treatment.

Foreign body in the ear or nose.—Generally a bean, pea, or small stone, pushed in by the child itself, constitutes the obstruction, and can in many cases be removed at once with a pair of small forceps, of which the angular ones shown in fig. 25 are very convenient for the purpose; or with the scoop, or even more readily with a simple loop of silver-wire slipped around it. Either direct sunlight, or a powerful artificial light reflected by a laryngoscope mirror on the forehead of the operator, should be employed in all cases of introduction into the auditory meatus of instruments, the points of which should never be out of sight. If the house-surgeon should not succeed at once (and he should be careful not to do any damage by poking about too much), recourse must be had to the syringe and warm water. The syringe should be of good size; but as the surgeon's object, particularly in the case of the ear, is to expel the foreign body by the *return* current of water, it is important not to use a syringe with a nozzle so large as to plug the meatus; and care should be taken to direct the water down to the membrana tympani along the roof of the canal, so that the return current may be as forcible

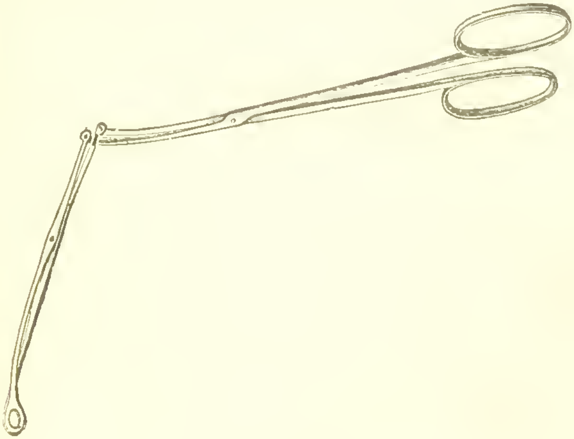


FIG. 25.

as possible. In the case of the nostril, the foreign body may often be conveniently pushed back into the fauces with a probe or small bougie. There is one caution necessary respecting the use of the syringe, which is, that when the foreign body is known to be of a vegetable nature, syringing, if used, must be persisted in until the body is removed at the same sitting, lest, if left to another time, the moisture should cause the body to swell, and so impede its ultimate removal.

Foreign body in the larynx produces symptoms of alarming urgency, the patient being often brought to the hospital black in the face and apparently moribund. The house-surgeon should immediately thrust his finger down the throat, in order to feel and displace any body, such as a lump of meat, &c., which may be obstructing the larynx; and if this is not feasible, an opening should be instantly made in the crico-thyroid membrane, so as to admit air to the lungs.

Laryngotomy is here recommended instead of tracheotomy, in the belief that, in these very urgent cases, the few moments' delay necessary for the performance of the latter operation, and particularly in somewhat inexperienced hands, is of the most vital importance; and besides, these very urgent symptoms are generally found in cases where the foreign body is impacted in the glottis, and has not passed into the trachea at all. Should tracheotomy be subsequently necessary for the extraction of the foreign body, the previous operation will be of no importance, and will offer no impediment to its due performance.

The urgent symptoms of suffocation having been thus relieved, aided, it may be, by artificial respiration, careful attempts should be made to ascertain the position of the obstruction; and if, as may be expected, it is discovered fixed between the vocal cords, efforts may be made to displace it by inverting the child and slapping its back pretty sharply, or by gently introducing an elastic catheter from below. When the foreign body has passed into the trachea, inversion of the patient, &c., may be tried, *provided laryngotomy has been performed*; for if this has not been done, the body may get impacted between the vocal cords and necessitate an instant operation. In those cases which are brought to the hospital for various degrees of dyspnœa, the result of a foreign body in the trachea or bronchi, the house-surgeon is not justified in interfering unless there is great urgency, but should summon the assistance of his senior officers, since these cases often require the most dexterous treatment, and throw a heavy responsibility on the operator.

Foreign body in the œsophagus.—Large masses of solid food occasionally get fixed in the œsophagus; but most commonly the foreign body is a bone (generally a fish-bone), or in rare instances a set of artificial teeth. If the foreign body is one which can be readily digested, or at least will pass through the intestinal canal without difficulty, the best treatment is to push it down into the stomach with a bougie or stomach-pump tube. When, however, a fish-bone is fixed in the mucous membrane, as can generally be ascertained by the pricking sensation experienced by the patient, an attempt should be made to dislodge it. A long forefinger, thrust well down the throat, may be made to hook up such an obstacle with the nail, supposing it is still in the pharynx; but if lower down, one of the numerous forms of probang must be used for the purpose, of which the ingenious horsehair probang,

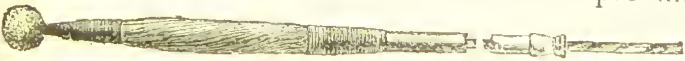


FIG. 26.

shown shut for introduction past the foreign body in fig. 26, and open for its withdrawal in fig. 27, is probably the safest and best. In the case of a coin fixed in the gullet, which may be demonstrated with the Röntgen rays, recourse may be had to the 'coin-catcher' (fig. 28), or to long curved forceps, which require, however, very careful manipulation. The removal of artificial teeth from the œsophagus is an

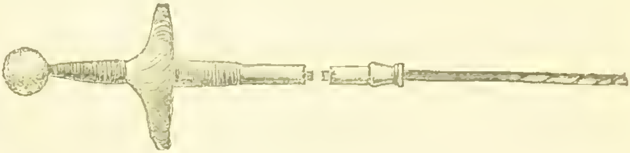


Fig. 27.

operation of great nicety, and one which the house-surgeon had better relinquish if he does not succeed

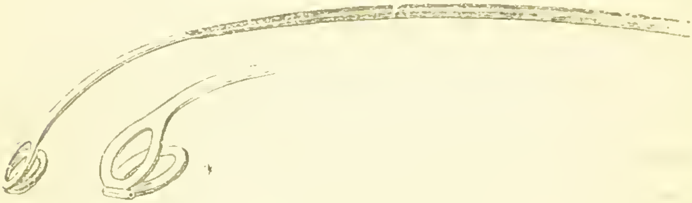


Fig. 28.

at the first trial with the long forceps, lest he do irreparable damage to the gullet, or render the extraction impossible except by œsophagotomy.

Foreign body in the urethra.—A piece of gutta-percha bougie is the most common example of foreign body in the urethra, and the house-surgeon should be very careful, both in examining its position and attempting its removal, not to push it further down the canal. The foreign body can sometimes be expelled by careful manipulation along the urethra, but if this is unsuccessful, attempts may be made to withdraw it with a slender pair of forceps, the finger being kept carefully upon the urethra behind the obstruction, so as to prevent its being carried on into the bladder. Should the house-surgeon not succeed in his attempts, the case should be submitted to the surgeon's opinion without delay.

Hair-pin in bladder and urethra.—Cases have frequently occurred of young women introducing a hair-pin into the urethra, which has slipped into the bladder, and required removal by the surgeon. This can best be accomplished with ordinary polypus or dressing forceps, if the urethra be rapidly dilated, under chloroform, with the forefinger insinuated along a director passed into the canal. The finger can turn the foreign body to the most convenient position for removal, and no permanent incontinence is likely to follow the proceeding. Owing to the short length of the female urethra, a hair-pin never becomes fixed in it so as to require surgical interference; but cases have occurred of a hair-pin introduced into the male urethra slipping from the patient's grasp and requiring removal by the surgeon. It is impossible to withdraw a hair-pin with forceps under these circumstances, because one or both ends of it will lacerate and become entangled in the mucous membrane; and therefore the better plan is to introduce a small tube (a silver probe-case, for example), and, having grasped the pin through the walls of the urethra so as to bring the ends together, to slip the tube over them, after which the pin can be readily withdrawn.

Foreign bodies in the rectum and vagina.—These cases are seldom of recent occurrence, and would not therefore require immediate treatment by the house-surgeon. In any recent instance recourse may be had to suitable forceps; but should they not succeed, the case may be very well put aside until the surgeon's visit.

CHAPTER III

RETENTION AND EXTRAVASATION OF URINE, HERNIA, ETC.

Retention of urine.—The cases of retention which the house-surgeon is called upon to treat are mostly of the spasmodic class, and result from some recent excess on the part of a patient whose urethra is not quite healthy; occasionally, however, patients apply at a hospital with retention from other causes—viz. permanent stricture, enlarged prostate, or atony of the bladder. Since the lower classes are generally reluctant to ask for assistance which may involve some personal suffering, a patient with retention ordinarily only applies at a hospital when the agony of his distended bladder becomes unbearable, and its immediate relief, therefore, by the catheter is of the first importance. The use of opium and the warm bath, &c., is only so much time wasted if the symptoms can be immediately relieved by the passing of a catheter; although, if this be impossible, they may afterwards be useful adjuvants in the treatment. Before entering upon any treatment, inquiry should be made of the patient (if sober) as to his ordinary powers of micturition, and the existence or not of a permanent stricture of some standing; but too much faith must not be placed on the statements of patients respecting the size of the stream passed, in which they commonly exaggerate.

Spasmodic retention.—Supposing no stricture to have previously existed, an attempt may be made to pass No. 6 or 7 English gum-elastic catheter without a wire; but even should a stricture be acknowledged, it is better to begin with at least No. 3 or 4. Of the positions for the patient—standing or of lying down—the latter is to be preferred, as giving the surgeon more control over the patient by preventing his drawing back. The practice varies, of course, in different hospitals; but every surgery should be furnished with a couch or table for a patient to recline upon, if desired. The selected catheter should be placed in warm carbolic lotion for a minute or two, and then be dipped in catheter oil. Standing on the left hand of his recumbent patient, the surgeon gently stretches the penis with the left hand, while with the right the catheter is inserted. With very slight force, almost by its own weight, the catheter should pass along the canal, until an obstruction is met with. Against this, gentle pressure with the end of the catheter should be made for some minutes; when, if the stricture be spasmodic, a gradual yielding will be distinctly felt, and in a few moments more the instrument will probably enter the bladder. This, the best possible result, can only be looked for in uncomplicated cases, where the urethra has been previously healthy. Should there be in addition some degree of permanent stricture, a smaller gum-elastic or silver instrument may be tried, although the very small sizes are unsuited to cases of spasmodic retention, and are apt to cause hæmorrhage and other mischief. Sometimes, when a catheter will not pass a stricture, if it be pressed against it for a time and then suddenly withdrawn, the urine will flow, and thus the retention will be relieved.

Should the house-surgeon not succeed in his first attempts, he must be guided in his further treatment by the condition of his patient. If the distress is not great and appliances are at hand, a warm bath may be administered, and thirty or forty minims of laudanum given internally, the probability being that, after the patient has been a quarter of an hour in the bath, the urine will pass of its own accord, or that a catheter will then be readily introduced. Should the distress of the patient be urgent, however, it is better to administer chloroform at once, and to use a catheter (No. 6 or 7) with the same precautions as are mentioned above, when the instrument will generally be found to pass with facility. Should this fail, there are still the warm bath, laudanum, and fomentations to fall back upon.

Inflammatory retention is often mixed up with the spasmodic variety, but there is one form which is purely inflammatory, viz. when a young man has inflammation of the prostate from gonorrhœa, or from other cause. Here the patient complains of weight about the neck of the bladder, and the finger introduced into the rectum finds the prostate swollen and tender. The gentle introduction of an elastic catheter guided by the finger in the rectum will relieve the retention, and very possibly evacuate the abscess of the prostate, if the inflammation has gone on to suppuration.

Permanent stricture, when giving rise to retention, is much more difficult to treat. Although, according to the patient's account, he has not been able to pass a *stream* for days, it is better to commence proceedings with a No. 4 (English scale), but the French soft instruments with an olive-shaped extremity are to be preferred. The patient lying down, the catheter selected should be carefully passed until it meets with an obstruction, the penis and urethra being drawn up and put on the stretch with the left hand. When the obstruction is reached, careful attempts should be made to pass it by withdrawing the catheter for half an inch, and rotating it between the finger and thumb so as to bring the point in contact with all parts of the stricture *seriatim.* Successively smaller sizes should be carefully tried in the same way until the smallest is reached.

Failing to pass an elastic instrument through the stricture, the house-surgeon must have recourse to a silver catheter. This should be carefully passed to the stricture, when the left hand should be carried along the urethra externally, to feel if there is any corresponding thickening at this point. The obstruction will generally be found in the region of the bulb, at the back of the scrotum ; and an endeavour should be made to guide the instrument through it, partly with the right and partly with the left hand. Not succeeding with No. 4, a series of cautious attempts with successively smaller instruments should be made, the left hand being still kept upon the urethra to serve as a guide for the median line—which it is, of course, most important to maintain, so as to avoid the formation of false passages.

Even if a catheter pass an obstruction at the bulb, it may fail to reach the bladder, and the operator will find that he is unable to depress the end of the instrument. Under these circumstances, the left forefinger should be inserted into the rectum, to feel if the catheter has taken the course of the urethra ; and if it be felt on one side of the middle line, it should be at once withdrawn from the false passage, and further efforts be made to carry it on in the proper direction, guided by the finger still retained in the bowel. Even when no false passage has been made, an instrument will sometimes meet with an obstruction just at or about the triangular ligament, and the finger in the rectum will be often able to help it over the difficulty. Should the patient be unruly or unable to bear the pain of these attempts, it will be well to put him under the influence of chloroform, although but little direct effect can be produced upon the stricture by that agent. Whatever instrument happens to reach the bladder should be retained and tied in until at least the case has been seen by the visiting surgeon ; for if withdrawn at once, the retention may again occur and treatment become necessary, possibly with a less successful result.

When no efforts of the house-surgeon suffice to relieve the bladder, the assistance of the senior officer should be requested without delay ; for if the distension be already great, a small further increase may cause the urethra to give way, and produce extravasation with its unfortunate results. In cases of retention of short duration, where there is little pain and the surgeon's visit may be soon expected, a dose of opium may be given and the delay allowed ; but bad cases should never be permitted to remain for hours unrelieved.

It is no part of the plan of this work to discuss the treatment to be adopted by the visiting-surgeon, which will vary according to both the individual surgeon and the nature of the case ; but should a house-surgeon be thrown upon his own resources, and be left to treat a case of retention on his own responsibility, he is strongly recommended to aspirate the bladder above the pubes, as being the simplest and safest proceeding.

Enlarged prostate gives rise to retention only in old people, and increase in the size of the gland can be readily detected through the rectum. Since the chief obstruction to the flow of urine is usually the central projection from the floor of the urethra, it will be necessary to use a prostatic catheter—*i.e.* one of the French instruments made with a bend or elbow near the extremity (*sonde coudée*), the point being kept along the roof of the urethra. Should this not pass readily, a large elastic catheter, with or without a stilette, may be used, or a large silver instrument, rather longer than usual, and with a greater curve. It is a great mistake to use small, short instruments in these cases, since they only perforate the prostate, giving rise to hæmorrhage, and never reach the bladder at all. The urine drawn off in these cases is usually bloody, from the congestion of the prostate, which has been probably the determining cause of the retention in a patient whose prostate has long been enlarged. This continues for a few days, during which the regular use of the catheter will be required.

Paralysis of the bladder from over-distension (atony of bladder) must not be confounded with retention caused by stricture. The obvious treatment is to relieve the over-distended viscus by means of a large catheter, for which purpose the soft india-rubber (Jaques) instrument is to be recommended ; and if the house-surgeon follow the rule of always beginning with a good-sized instrument, he can hardly fall into the error of making false passages in a previously healthy urethra. If any doubt should exist as to whether the catheter has entered the bladder or not, it will be immediately solved by throwing in a little warm water with the india-rubber bottle. This will, of course, distend an empty bladder, but will not enter at all if the instrument has not (as is most probable) reached the viscus, and a *longer* catheter should be at once employed. Over-distension of the bladder gives rise also to another symptom—viz. an overflow or involuntary dribbling away of urine ; and this must not be confounded with the want of power over the neck of the bladder by which the viscus is always kept empty. The diagnosis is easily made by percussing the region of the bladder and noticing the extent of dulness ; and the rational treatment is to pass a catheter.

Retention from calculus occurs usually only in children, and may often be overcome by making the child lie on its back during micturition ; if this does not succeed, a catheter suited to the size of the urethra may be readily introduced. In such cases an early opportunity should be taken to determine the presence of a stone, in order that appropriate treatment may be undertaken.

A small calculus may become impacted in the urethra of a child, and thus produce retention either partial or complete. Frequently the calculus is arrested just within the meatus, and can be extracted with a small scoop ; but if farther down, urethral forceps must be employed. If the house-surgeon is unsuccessful in his attempt to extract the calculus in this manner, the visiting surgeon should be summoned to cut down upon it without delay, since an impacted calculus may give rise to extravasation of urine by causing ulceration through the urethra.

The same rules would apply to a piece of calculus impacted in the urethra after lithotrity, though in that case, if the fragment is near the bladder, an attempt may be made to push it back into that viscus with a large catheter or bougie.

Retention in the female occasionally requires the use of the catheter, though, since it is generally an hysterical symptom, the use of instruments, &c. should be avoided as much as possible. The patient should never be exposed for the passage of a catheter, but she should be placed on her back with her knees drawn slightly up. Standing on the right of the patient, the surgeon will next pass the left hand between the thighs, and place the forefinger just at the orifice of the vagina. An elastic catheter can then be readily introduced with the right hand, and, being made to glide over the forefinger of the left, will almost infallibly enter the urethra, being felt through the wall of the vagina immediately beneath the arch of the pubes as it passes to the bladder. The so-called tubercle at the orifice of the urethra is generally imperceptible, and likely to be confounded with the clitoris ; and it is therefore safer to disregard it altogether, and to proceed as suggested above, but a light should be used rather than allow a patient to be unrelieved.

Extravasation of urine may occur either from the urethra giving way after prolonged distension of the bladder, or may be caused by the unskilful use of the catheter having made a hole in the urethra. Occasionally the urethra is ruptured by direct violence, such as a fall astride a piece of timber ; or is torn in cases of injury to the pelvic bones from any crushing force. In any case the result is the same : the urine gets into the areolar tissue of the scrotum and penis, which it distends, and, if unrelieved, will find its way over the pubes and into the groins of the patient. If seen early the distension will simulate that of ordinary œdema, but in a very few hours the skin becomes scarlet and then dusky ; black sloughs show themselves at various points, and an erythematous blush spreads for some distance towards the abdomen.

A house-surgeon should not treat a case of extravasation on his own responsibility if he can obtain the assistance of a senior officer at once, but he is not justified in waiting more than a short time for this. If obliged to act on his own responsibility, he should have the patient held in the lithotomy position, and make free incisions in the median line of the distended perinæum, on each side of the scrotum and penis, and wherever the urine appears to have found its way. These incisions need not be very deep, so long as they give exit to the infiltrated urine, which will be easily recognised by the peculiar smell. Any small vessels which may bleed should be at once twisted or tied, as it is important that the patient should not lose any blood. In cases where the extravasation is great, and the necessary incisions evidently give free exit to the urine contained in the bladder, it is better to abstain altogether from passing a catheter along the torn urethra for a few days, until the parts have become more healthy, since the urine will run away through the incisions as readily as through the wound made in lithotomy. When, however, the extravasation is small, and perhaps only one sided, and the incisions are therefore not large or deep, it will be necessary to get an instrument into the bladder in order that no more urine may be effused; and the house-surgeon should make careful attempts to introduce a catheter, using both elastic and metallic instruments for that purpose; and he will often be able to succeed, even in cases of old stricture, the effect of the effusion being to relax slightly the strictured parts. An instrument having been introduced should be tied in, and light linseed-meal poultices sprinkled with iodoform should then be applied to the pubic region and frequently changed, while measures should be taken to secure the constant flow of urine through the catheter, if one has been introduced, either by adapting some form of urinal to it or by frequently removing the stilette.

If, however, the house-surgeon should find himself unable to introduce a catheter, he must await the arrival of the visiting surgeon, who has been already summoned, and who will probably lay the urethra open through the perinæum, and pass a catheter into the bladder. The house-surgeon is warned against undertaking the operation of opening the urethra on his own responsibility, since none is more difficult to complete satisfactorily; and the patient being already in a dangerous condition, the possible fatal result may be attributed to his interference.

A patient suffering from extravasation of urine is always in a depressed condition, and will require very careful after-treatment, with plenty of nourishment and some stimulants, at all events at first. In order to bring away the sloughs, and also to prevent the patient being poisoned by the offensive discharges, he should be lifted daily into a hip-bath of warm boracic solution and allowed to soak for a quarter of an hour, after which portions of slough may be pulled or cut away and fresh iodoform be blown on the part.

Since false passages are occasionally made by the best surgeons, extravasation may occur in a patient already in the hospital and under treatment for stricture, and the house-surgeon should not mistake the erythematous blush and slight œdema which mark the accident for an attack of erysipelas. The same remark applies to extravasation in children, caused by impaction of a stone in the urethra.

Washing out the bladder is an operation generally entrusted to the house-surgeon, and its careful performance is a matter of great importance, both in cases of diseased bladder and in cases of paralysis, the result of injury to the spine or from other causes. When it is simply desired to wash out any accumulation of mucus or sediment from the bladder, a good-sized elastic catheter with a large eye is the best instrument; or when any particles of earthy deposit may be expected, the very large-eyed catheter used after lithotrity will be of advantage. The catheter having been introduced with the greatest care (and more particularly so in cases of paralysis, where sensation is wanting), the bladder should be thoroughly emptied, pressure with the hand being made over the pubes if necessary, to assist the expulsion of the contents. In doing this with an elastic catheter, it is well to bear in mind that the wall of the bladder, as it contracts, is apt to press against the eye of the instrument and obstruct the flow of urine, and that this is easily remedied by drawing the instrument out for an inch or so when the event happens. The simplest, and therefore best, injecting apparatus is a small india-rubber ball, with nozzle and pipe, and bullet-valves (fig. 29). The ivory nozzle at the end of the

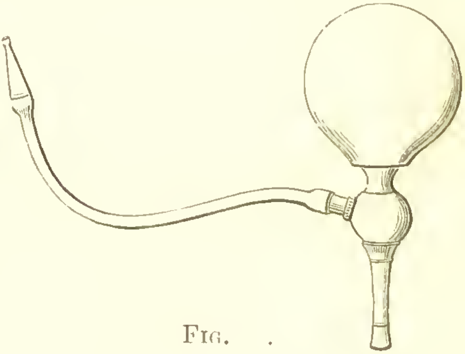


FIG. .

india-rubber pipe may be either inserted into the catheter, or, the nozzle having been removed, the pipe itself may be fitted over the end of the instrument, if the size will allow it. The only precaution necessary to observe in employing this little apparatus is to keep it *upright* when in use, since that position alone enables the bullet-valves to act properly. A shake will occasionally be requisite if the bullet gets fixed for a moment, but the house-surgeon should beware of officious assistants unscrewing the joint and letting the bullet drop out. The bottle should be filled with tepid water before it is attached to the catheter, so as to avoid the injection of air, and then, by a series of gentle squeezes, as much tepid water as may be desirable can be readily thrown into the bladder. This water should be allowed to run out into a fresh vessel, and the injection may be repeated as often as necessary.

In some cases the use of a double catheter may be desirable; but the same bottle can be used with it, unless the more cumbrous metallic syringe is for any reason preferred. Medicated injections generally require a gilt catheter; but, if weak, they will not do any serious damage to the india-rubber bottle, which must, of course, be carefully washed after being so used. Probably the best injection for restoring a healthy condition of the urine is a solution of sulphate of quinine, gr. ij–x, water f℥j, with two minims of dilute sulphuric acid.

The siphon tube with funnel used for washing out the stomach (fig. 65) may also be used for the bladder, care being taken to avoid the introduction of air by having the tube thoroughly filled with warm water before it is attached to the catheter.

Washing catheters.—It is very important that catheters, and particularly the smaller sizes, should be carefully cleansed after being used. The house-surgeon should not leave this to a nurse, but should either do it himself, or see that a dresser thoroughly washes each instrument.

The best way is to let the catheter lie for a few seconds in the water and then to hold it up with the handle or rings downwards, by which means any blood, &c., is at once washed out in the readiest way. This should be repeated once or twice, and then the operator may blow through the instrument into the water, so as to make sure that the eyes are clear. After being dried with a towel, the catheter should again be blown through, so as to dry the interior, and the proper stilette be immediately inserted.

The common method of blowing down a catheter *before* washing it out simply drives any clot of blood, &c. down to the eyes, and makes its extraction nearly impossible. Catheters are now made with the insides as smooth as the outside, and solid beyond the eye, so as not to retain any dirt.

In order to obviate all possibility of contagion by means of catheters, it is well to use a weak solution of carbolic acid for washing all urethral instruments, and to employ carbolic oil (gr. x ad f℥j) for lubricating them prior to use. Mr. Lund recommends for this purpose a mixture of almond oil f℥ jss, castor oil f℥ss, crystalline carbolic acid ʒj.

Paraphimosis.—Boys are sometimes brought to a hospital on account of the foreskin having got behind the glans penis, so that they are unable to return it; and the disorder will be met with in men as a not uncommon accompaniment of gonorrhœa. If the case is seen early, reduction is readily effected; but if œdema and even ulceration have supervened, it is by no means an easy task, but one which may be invariably accomplished in the following way:—The patient should be placed upon a couch, and the operator, grasping the foreskin with the fingers of both hands (a towel intervening), should squeeze the blood and serum out of it as much as possible. The thumbs are then to be placed against the glans, and made to compress it in the same way, after which endeavours should be made to draw the foreskin forwards, and at the same time to push the glans in with the thumbs. After a few minutes' steady traction the parts will assume their proper position, unless the foreskin has become ulcerated and its surfaces agglutinated together. Water dressing should afterwards be applied around the penis, which must be supported by a bandage.

A few punctures on the swollen prepuce, and the application of a piece of elastic webbing or india-rubber band tightly round the part for a few minutes, will be found to tend greatly to remove the swelling; and in cases where the congestion of the organ rather than the amount of œdema is the cause of difficulty in effecting reduction, the application of a stream of cold water from an ordinary tap for a quarter of an hour will much facilitate the proceeding.

Appearances closely resembling paraphimosis are sometimes caused by a child having tied a thread round the penis, either in play, or with the view of obviating punishment for wetting his bed. In these cases the thread becomes so embedded in the swollen tissues as to require great care for its discovery and division.

Strangulated hernia.—It is the exception rather than the rule for patients to apply at a hospital ostensibly for relief of a strangulated hernia. Having, probably, never been warned upon the subject, they regard the rupture as of secondary importance, and apply for relief of the constipation, pain, or sickness consequent upon strangulation. In all cases, therefore, of pain in the abdomen with constipation, it is well to direct attention to the possible existence of a rupture, since the patient seldom or never volunteers the information. If there is the slightest suspicion in the house-surgeon's mind, nothing but actual manipulation should satisfy him, since a hernia of small size may exist without the patient's knowledge; or, although he may acknowledge to a rupture on one side, he may ignore one on the other, which may possibly be strangulated. In children the possible existence of an intussusception, causing many of the symptoms of strangulation, must not be overlooked. The presence of a sausage-shaped tumour in the abdomen, and the passage of bloody mucus *per anum*, would be diagnostic points.

Herniæ that become strangulated are generally of old standing, which some exertion has increased in size, since which time the patient has been unable to return the bowel; but a hernia may be produced and strangulated at one and the same time by violent exertion or by some crushing force. Thus, after the peace illuminations of 1856, a woman lost her life from a strangulated femoral hernia, produced and strangulated by the pressure of the crowd — the tumour, which was of small size, being mistaken at first for an enlarged gland.

The diagnosis of strangulated hernia is often difficult, both in the inguinal and femoral varieties, it being in the former confounded with other scrotal tumours, and in the latter with enlarged glands. The scrotal tumours most likely to be confounded with strangulated hernia are hæmatocele and inflamed testicle; and the following table may assist the house-surgeon in distinguishing them, though it must always be remembered that hernia may co-exist with other tumours: —

Strangulated Hernia.	*Hæmatocele.*	*Orchitis.*
Suddenly produced by some effort of the patient; or, if hernia existed before, strangulated in that way.	Suddenly produced by some external violence.	Gradually developed, after gonorrhœa or a blow.
Pain in groin and about abdomen, with considerable constitutional depression and anxiety of countenance.	Pain in scrotum and constitutional disturbance slight after the first few minutes.	Pain in scrotum and along the cord to the loins. Feverish disturbance of system.

Strangulated Hernia.	*Hæmatocele.*	*Orchitis.*
Tumour tense, and giving the sensation of intestine to the hand when manipulated. Skin normal.	Tumour tense and heavy, globular in shape, but not translucent. Skin discoloured.	Tumour excessively tender to the touch: cord thickened. Skin reddened.
Impulse on coughing to be felt along the groin, in which there is more fulness than usual, but ceases abruptly at the point of strangulation.	No impulse in groin, which is perfectly normal.	No impulse on coughing.
Percussion over tumour gives a clear sound unless the protrusion is omental.	Percussion yields a dull sound.	Percussion yields dull sound.
Vomiting probably present and *continuous.*	Vomiting immediately following the accident, but not continued.	Nausea and faintness, but seldom vomiting
Testicle to be felt below and behind hernia.	Testicle not to be felt.	Testicle enlarged and tender.

Having ascertained the existence of a hernial tumour, it will be the duty of the house-surgeon to inquire very particularly as to the probable duration of the strangulation, the symptoms to which it has given rise, and the amount of tenderness present in the part. A very few minutes only need be thus occupied, but the after-treatment will be guided very much by the knowledge thus gained ; for, should the hernia be of only recent strangulation, there need be no bar to the careful application of the taxis. But should the strangulation have been allowed to persist for many hours, or even days, and more particularly, should the pain which was at first present have ceased altogether, and the patient be passing into a state of collapse, the assistance of one of the senior surgeons had better be summoned at once, lest the house-surgeon have the mortification of finding, *post mortem*, that he has ruptured the congested or mortified intestine by his efforts, and returned the fæcal contents into the peritoneal cavity. The amount of manipulation the hernia may possibly have been submitted to before the patient's admission should also be taken into consideration, for if the taxis has been attempted by a medical man, recourse had better be had to chloroform at once ; but additional caution in manipulating will be necessary, as it is impossible to say what amount of injury the intestine may have already undergone.

Interference on the part of the house-surgeon, then, not being contra-indicated, the patient should be placed upon a bed or table, with the shoulders well raised by pillows; the thigh of the affected side is next to be bent upon the abdomen and towards the opposite side, so as to relax as far as possible all the structures in the neighbourhood of the groin. With the fingers of both hands the house-surgeon should then manipulate the parts about the neck of the sac, where the strangulation will probably exist, and make firm but gentle efforts to return the contents of the sac bit by bit, and not attempt to push the whole mass back by main force, or by grasping the bulk of the tumour with both palms. A gurgling sound is an indication of success, and should induce the surgeon to continue his manipulations until the whole of the contents is returned; but if after some minutes' trial there is no symptom of progress, and more particularly if so much pain is given as to induce the patient to strain and move himself about, *chloroform* should be at once resorted to. The by no means novel method of assisting the reduction of a hernia by holding up the patient's legs, and so making the weight of the intestines drag upon the sac, may be had recourse to if the patient is unconscious. It has the disadvantage of tightening rather than of relaxing the parts in the groin, but certainly is of service in some cases.

Chloroform, to be of any use in a case of strangulated hernia, must be given until total insensibility and complete relaxation of the muscles have been produced. An assistant taking charge of the inhaler, so as to keep the patient under its continuous influence, the house-surgeon should repeat his efforts at returning the intestine; but if success do not follow in a few minutes, he should desist, and send for the surgeon under whom the patient is admitted, the patient being allowed to recover from chloroform, and being placed in a warm bed.

In old-standing hernia it is frequently impossible to empty the sac completely, owing to the quantity of thickened omentum present. This is of no importance so long as the gut is returned entirely, the best criterion of which is, first, the relaxed state of the sac, and, secondly, the relief from pain experienced by the patient upon recovery from chloroform. The house-surgeon should not suffer himself to feel annoyed if the surgeon, upon his arrival, is able to return a hernia without operating. It is remarkable how slight a change in the parts may influence the feasibility of this proceeding: thus it happened once to the author, when a house-surgeon, to have sent for the surgeon, after having unsuccessfully applied the taxis under chloroform to a case of scrotal hernia, but before his arrival the hernia had gone up spontaneously, to the patient's great relief. In any case, as soon as a hernia is returned a pad and bandage should be carefully applied, so as to prevent its recurrence.

Reducible hernia is usually treated by some form of truss. In both male and female infants inguinal hernia is the commonest form, and a convenient and cheap support may be made out of a skein of worsted.

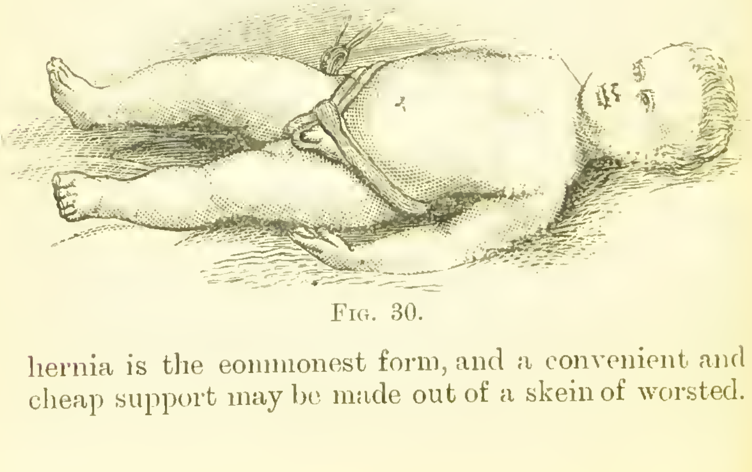


FIG. 30.

Berlin wool is made into a skein of twenty double threads, about twenty-two inches long, the threads being tied across at two-inch intervals to keep them together. The hernia having been returned, the loop is placed over the ring and the skein carried round the pelvis and brought along the groin of the affected side, where it is passed through the loop and taken round the back of the thigh, to be attached on the outer side with a safety-pin or tied (fig. 30).

To measure a patient for a truss, a tape should be taken round the pelvis between the crest of the ilium and the great trochanter, and the circumference be noted.

Umbilical hernia in children is best treated with adhesive plaster applied so as to draw the recti muscles together. Two strips of good adhesive plaster, $\frac{3}{4}$-inch wide and six to seven inches long, are placed one on each side of the abdomen, as shown in fig. 31, one half only of each strip being applied to the skin. The exomphalos being reduced, the strips are drawn tightly across the abdomen without any pad, and are fixed on the opposite sides.

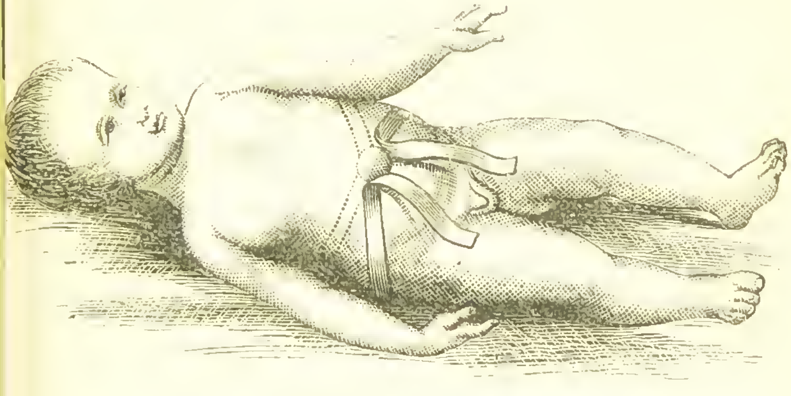


FIG. 31.

Prolapsus ani.—Children, and occasionally adults, are sometimes brought to the hospital with prolapse of the rectum. In recent cases the part is readily enough returned by the pressure of the fingers, the gut being grasped by the use of a piece of lint, which it will be found advisable to return along with the bowel and to leave in, as it tends to keep up the prolapse, and will be displaced by the passage of fæces. In old cases, where the mucous membrane has been fretted by the clothes, and may perhaps have ulcerated, the part should be well sponged with cold water before the attempt at reduction is made; and should much difficulty be experienced, chloroform had better be resorted to at once, so as to relieve the spasmodic contraction of the sphincter. A pad of lint and a T-bandage should be applied to prevent the immediate recurrence of the prolapse, and suitable treatment be adopted for its radical cure. Since prolapsus ani is a frequent accompaniment of stone in children, an early opportunity should be taken to ascertain the existence of a calculus in the bladder.

Rape.—Female children are occasionally brought to a hospital by their parents or the police on the supposition that they have been raped; and since legal inquiries are likely to arise, the house-surgeon must be very circumspect in conducting his investigations. First, he should note the time when the patient is brought to him, and then proceed to examine her. He should remove the patient's drawers, and retain them for subsequent examination, and should notice any external bruises or scratches, and then make a special examination of the genitals. The general appearance of the labia, whether bruised, inflamed, or merely reddened; the condition of the hymen, and the state of the vagina and perinæum, should be specially investigated, as also whether any discharge is present or not. When the alleged assault is recent, the microscopic examination of the vaginal mucus should not be neglected. A small quantity should be removed with a pipette (care being taken to wash it thoroughly first) from *within* the hymen, if that membrane is torn, and submitted to the microscope, when spermatozoa may be discovered, and even in motion.

By this means the author was, on one occasion, able to convict a man of rape, the child having been brought to the hospital two hours after the assault.

When the investigation is already in the hands of the police, it is no part of the surgeon's duty to put any questions to the child ; but when, as often happens, his *dictum* will determine the parents in their after-proceedings, he must necessarily investigate the whole occurrence. Since in by far the greater number of cases the suspicions of the parents have been unnecessarily aroused, the house-surgeon should be careful to hear the mother's account and that of the patient *separately*, and not in each other's hearing. This is more particularly necessary as respects the child, who may have been frightened or over persuaded into accusing some innocent person of an assault, while the disorder she is suffering from, if any, is simply the result of natural causes. In these, as in all other medico-legal cases, the house-surgeon should immediately make a few notes of the principal features of the case, and particularly of the dates, that he may be able to give evidence at any subsequent trial, if called upon to do so.

CHAPTER IV

THE IMMEDIATE TREATMENT OF CASES OF POISONING

SINCE cases of poisoning not unfrequently come under the care of the house-surgeon, although, strictly speaking, they more properly belong to the medical side of the house, the diagnosis and immediate treatment of the more common forms will be described in this chapter. The after-treatment of poison cases will necessarily become the duty of the visiting medical officer, and will therefore require no further mention here.

Alcoholic poisoning.—In the slighter cases, the diagnosis is readily made from the history of the patient, who has probably been 'on the drink' all day, and his semi-conscious, drowsy condition, coupled with the strong odour of spirits exhaled by the breath. The pupils are usually contracted, and, when the patient is roused, they suddenly dilate and recontract as he dozes off again, grumbling at being disturbed. But in more severe cases, and when the history is wanting, the diagnosis between drunkenness, apoplexy, and head-injury is both difficult and important. Thus, when a person is found lying incapable in the streets, and is brought to a hospital by the police, it is necessary to decide at once whether it is a case for the station-house or for the wards.

The external appearances of the patient will serve as a guide, in some degree ; for if respectably clothed, with no appearance of disorder of dress, &c., but those dependent upon a fall in the street, the probabilities are that it is *not* a case of drunkenness. If, in addition, there is no trace of alcohol in the breath; if the pupils are unequally contracted or dilated, and the patient cannot be roused in the slightest degree, the diagnosis of apoplexy will be confirmed, and the patient should be at once admitted.

Persons are occasionally brought to the hospital from the police cell, where they have been lodged some hours for real or supposed drunkenness, owing to the officers having become alarmed at the supervention of stertorous breathing. The case may have been one of apoplexy from the first, or it may be one of apoplexy following drunkenness, and must be admitted at once, or death may unfortunately occur at the station-house.

It sometimes happens that laudanum is taken with, or after, a quantity of spirits, and in such a case the symptoms of the narcotic will predominate, and the patient must be treated accordingly. (See Opium-poisoning.) A very excessive dose of pure spirit (drunk for a wager, or given to a child) will produce almost immediate death by *shock*, all the symptoms of which are presented in a marked degree.

Treatment.—To empty the stomach is the first indication, and this may be readily accomplished, if the patient is able to swallow, by the administration of an emetic (Zinci Sulph. ʒss. cum Pulv. Ipecac. ℈j) in plenty of warm water, or by the subcutaneous injection of Apomorphia gr. $\frac{1}{10}$ to $\frac{1}{4}$. When the emetic begins to act, care should be taken to support the patient so that the vomited matters may be at once ejected and not swallowed again, or perhaps find their way into the windpipe.

Should the case be more severe, and the patient unable to swallow, recourse must be had to the syphon-tube (fig. 65) or to the stomach-pump, which must be introduced through a gag, with the precautions mentioned at p. 147, when warm water may be injected, and the stomach thoroughly washed out. Cold affusion is the most readily applied means of rousing the patient, and for that purpose the water should be poured from a slight elevation upon the head and chest. In addition, flipping the bare skin with a wetted towel is a very effective stimulus, particularly if applied to the soles of the feet and calves of the legs. In cases of very profound coma, mustard poultices to the calves and feet, stimulating enemata, and faradism may be employed to rouse the patient from the effects of the shock; whilst it may be necessary to administer small doses of diffusible stimulants—ammonia or ether—by the mouth, to excite the flagging vital energies.

Coma
1 Mustard P. to calves
2. Stimulg enemata
3. Faradism
4. NH_3 or Ether

Opium-poisoning.—Laudanum is the preparation commonly employed, and in the majority of cases the diagnosis is at once simplified by the discovery of the bottle which contained the poison by the patient's side or in his possession, and this may either be labelled, or may contain a minute residue of the tincture, to be readily recognised by its characteristic odour and taste.

If seen soon after the administration of a large dose of laudanum, the patient will only be in a drowsy and stupid condition; but if sufficient time has elapsed for the poison to have produced its full effect (the period varying according to the dose and the condition of the stomach), there will be profound stupor, from which the patient can be roused only by great efforts, the breathing will be slow and feeble, and the pupils of the eyes *very strongly contracted.*

The distinction between opium-poisoning and apoplexy is sometimes required; and the conditions of the pupil and of the respiration are the best diagnostic points;—in opium cases the pupils being *equally* and strongly contracted, and the respiration quiet and slow; in apoplexy the pupils being *unequally* contracted or dilated, and the breathing laboured and stertorous.

Treatment.—The stomach is to be immediately emptied by the stomach-pump or an emetic (*vide antea*), and the contents should be examined to confirm, or otherwise, the diagnosis made. The stomach should then be thoroughly washed out with warm water containing enough Condy's fluid to make it pink, until all trace of the laudanum has disappeared.

1. Wash out stomach c̄ Condy's fluid.

Cold affusion may be used to rouse the patient from his comatose condition, and he should then be made to walk about, supported by two attendants, who should shake him and shout at him so as to prevent his dropping off to sleep.

2. Cold affusion
3. Exercise
4. Hot inf of coffee.
5. Permang of Potash 5 gr. qu. hor.

[In hospital practice it will be found a great convenience to send to the nearest police-station for two constables to perform this duty, and the inspector will send relays of men as long as they may be required.]

Care should be taken that the patient has his shoes on during these forced marches, or his feet will suffer severely from the rough usage. The house-surgeon may apply an additional stimulus if necessary, by flipping the bare skin with a wet towel or a light cane; but of course this treatment must only be very moderately applied.

Strong coffee should be given at intervals as soon as the patient can swallow readily; and the house-surgeon must pay attention to the state of the pulse, for nothing can be more exhausting than the treatment pursued, and stimulants should therefore be administered in small quantities if the patient's powers appear to be flagging, more particularly if the attempted suicide is the result of want. Five-grain doses of permanganate of potash, given in solution every four hours, have been recommended as a specific in opium-poisoning.

Care must be taken not to prolong the active treatment unnecessarily, for a patient has been known to have died of the exhaustion so produced, and to have shown unmistakable signs after death of the over-zealous treatment to which he had been subjected. If moderately sensible, half an hour's rest and sleep at a time may be allowed until the dangerous symptoms have quite passed off, when the patient will probably require some days' rest before he is convalescent.

In very bad cases, when the respiration is failing, $\frac{1}{60}$ grain of Sulphate of Atropia (six minims of the B.P. solution) may be injected subcutaneously; or thirty minims of the Tincture of Belladonna may be given by the mouth, and recourse had to artificial respiration.

Chloral-hydrate.—The symptoms resemble those of opium-poisoning, but the contracted pupils dilate when the patient wakes. The face is livid, but the skin of the body cold. The respirations are diminished in frequency, and often become stertorous. (Murrell.)

Treatment.—The same as for opium-poisoning.

Oxalic acid.—This is a not unfrequent agent in cases of poisoning, accidental or suicidal, the symptoms being an intensely sour taste in the mouth, followed by pain in the throat and stomach of a burning character. Vomiting may or may not be present.

Treatment.—Chalk suspended in water should be immediately administered, or magnesia if more readily obtained. Warm water may be given to encourage vomiting after the administration of the antidotes, but the stomach-pump should not be employed, on account of the damage the œsophagus and stomach have sustained.

Hydrocyanic acid and the cyanides.—Cases of poisoning by these agents are so rapidly fatal as ordinarily to be beyond medical aid. Should a case be seen before death has occurred, the suitable treatment would be cold affusion to rouse the patient, followed by warm frictions to the skin, ammonia to the nose, and an emetic as soon as the patient can swallow.

Mineral acids.—Poisoning by the mineral acids is readily recognised by the immediate violence of the symptoms, and the burns and stains upon the lips and clothes.

Treatment.—The administration of magnesia or chalk suspended in milk or oil. Stomach-pump *not* to be used, for the reasons given above.

Caustic alkalies.—A solution of caustic potash, or what is termed 'soap-lees,' is the fluid most commonly taken by accident. A burning pain in the throat and stomach follows immediately upon the dose, and vomiting of grumous matter soon occurs. The reaction with reddened litmus paper would immediately decide the diagnosis if there were any doubt.

Treatment.—Vinegar and water, or very dilute lemon-juice, together with olive or almond oil.

Carbolic acid.—Since the general introduction of carbolic acid as a disinfectant, many cases of fatal poisoning have occurred through its being mistaken for other fluids. A large dose of the strong acid is almost immediately fatal, but the use of the stomach-pump, and washing out with a weak solution of soda, followed by the free administration of olive oil, offer the best prospect of relief. It has been recommended to administer the soluble sulphates, which will combine with the carbolic acid and form a sulpho-carbolate.

To guard against accidents of this kind, all strong solutions of carbolic acid should be kept in coloured fluted bottles, and be distinctly labelled.

Strychnia.—Some form of 'vermin-killer' is the usual form of this poison, and the tetanic symptoms, with well-marked opisthotonos, which rapidly follow the administration, sufficiently distinguish it.

Treatment.—The prompt use of the stomach-pump, or emetics if the spasms have already set in. Afterwards, Bromide of Potassium ʒij, c̄ Chloral Hydrate gr. x, every quarter of an hour, followed by the inhalation of chloroform. (Murrell.)

CHAPTER V

MINOR OPERATIONS

Laryngotomy.—Since this operation is advisable in the case of any sudden obstruction of the larynx, when every moment is of the utmost value, its rapid performance is of consequence, and so long as an opening is made in the crico-thyroid space it is a matter of minor importance how the incision is made. The finger carried up the middle line of the neck will readily enough, in men, distinguish the depression between the cricoid and thyroid cartilages; but in women and children, in whom the thyroid cartilage is not prominent, doubt may arise, unless the operator remembers that the hard ring of the cricoid cartilage is always distinguishable, and that the opening is to be made above this. The part being steadied with the fingers, the knife, held short so that not more than half an inch of the blade projects beyond the finger and thumb, may be plunged in transversely without hesitation, and if a free opening be made, the parts will gape sufficiently to allow an entrance for the air, but if not, they may be easily held apart until a tube can be procured. If necessary, the tube can be inserted readily enough; and it may not be superfluous (judging from what one sees in operations on the dead subject) to remind the young operator that the end of the tube must be directed downwards. The tube is easily maintained in position by a tape round the neck. It is usually recommended to make the superficial incision vertical if the operation is undertaken for chronic disease, and there is therefore no great cause for haste.

Tracheotomy.—This is frequently one of the most trying operations the house-surgeon will be called upon to perform, and it is essential for success that he should be thoroughly up in all its steps, and ready for every emergency. In children, the small size of the trachea and the closer proximity of the vessels render the performance of tracheotomy more arduous than in the adult ; and the house-surgeon should take every opportunity of examining the relative anatomy and of performing the operation in the dead-house, both on adults and children. Opinions differ as to the part of the trachea which should be opened—above or below the isthmus of the thyroid body. Undoubtedly the operation is easier above the isthmus if it occupies its ordinary position, and the chances of hæmorrhage are less. On the other hand, if the case is one of laryngeal disease, the irritation of the tube may keep up mischief in the larynx, if it is placed too near that organ. In selecting the point for opening the trachea, the surgeon must be guided mainly by the condition of the parts : if the trachea is superficial and easily reached above the isthmus, he had better open it there ; if, on the contrary, the isthmus is high and broad, and the trachea exposed below it, he should select the latter situation.

For the successful performance of the operation, the position of the patient is of importance. The head should be thrown back so as to stretch the neck and draw up the trachea as much as possible ; but as the patient is generally struggling for breath, the recumbent position is almost an impossibility, though of course advisable. A caution is necessary here, and specially with regard to children—viz. not to let an over-zealous assistant draw the head so far back (at the same time closing the jaws) as to suffocate the patient before the operation is begun.

The operator should see that he has everything he may want close at hand—viz. scalpels, forceps, tenaculum, blunt hooks, tracheotomy tubes of different sizes and lengths, ligatures, sponges, &c.

The operator, being on the patient's right hand, and having a trustworthy assistant at the patient's head provided with a blunt hook in each hand, makes an incision from the cricoid cartilage downwards for a couple of inches, if intending to operate above the isthmus; or beginning lower down, to the top of the sternum, and even for a little distance on the bone, when the neck is short and it is intended to operate below the isthmus; in both cases keeping very carefully in the median line. A rapid but careful dissection must then be made between the sterno-hyoid muscles, which are to be held aside by the assistant, down to the trachea, avoiding both the isthmus of the thyroid gland, which should be pushed with the finger up or down according to the operation intended, and also the veins, superficial or deep, which should be held aside by the assistant with a blunt hook or pair of forceps. In the high operation, by detaching the fascia from the lower border of the cricoid cartilage with a transverse cut, the isthmus of the thyroid and any veins can be readily pushed down with the handle of the scalpel. The trachea being exposed, a tenaculum should be fixed into the upper part of it, by which it may be drawn up and steadied, and the knife, being held with the *back downwards*, should be thrust into the windpipe three or four rings below the tenaculum, and made to cut up to it. In thus entering the knife, the surgeon must be careful not to transfix the trachea, or even wound the œsophagus—which accidents are best guarded against by allowing only half an inch of the blade to project beyond the finger and thumb. The fact that the trachea has been opened will be immediately manifested by the rush of air and the expectoration of mucus through the wound, and a tube should be at once inserted, unless the operation has been done for a foreign body, which it is hoped may be ejected by a forcible expiration through the wound, which must for this purpose be held open with hooks or a tracheal dilator (fig. 32).

The insertion of the tube is often the most critical part of the operation, but has been much facilitated by the invention of collapsing tubes, which when closed resemble a wedge, and can therefore be readily introduced, and expanded afterwards by means of the second tube, which fits inside. If the surgeon is not provided with these tubes, he will overcome the difficulty by passing the handle of the scalpel into the *upper* part of the incision, and then turning it so as to bring it at right angles to the trachea. This has of course the effect of opening the incision, and will allow an ordinary tube to be slipped in with facility below the handle. Some surgeons insert a tenaculum into one side of the trachea, and use it afterwards to make traction upon the incision; while others prefer to insert the tenaculum at the spot where the tube is to go, and then cut round it, removing completely a portion of one or more rings.

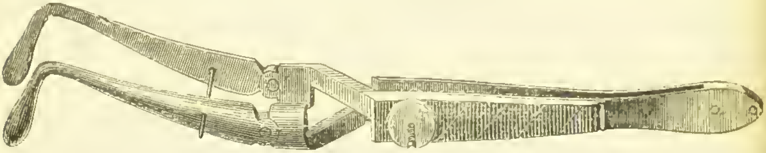


FIG. 32.

The dangers of hæmorrhage in the operation of tracheotomy are somewhat exaggerated. So long as the surgeon keeps steadily in the middle line he is not likely to meet with any large vessel in the adult, and in the child the innominate vein is seldom in danger if the knife is held as directed in the deep incision. The sources of hæmorrhage are the veins, which are generally much congested, and may be found immediately in the line of incision; in which case a steel director may be substituted for the scalpel in the deeper dissection with advantage, and the trachea thus be exposed. The rule has been laid down not to open the trachea until all bleeding has ceased; but as the hæmorrhage depends upon the dyspnœa and consequent congestion, this rule cannot be implicitly obeyed, and, provided there is no arterial hæmorrhage, the trachea may be safely opened after douching with hot antiseptic solution. What little blood enters the windpipe is immediately coughed out again and does no harm, and it would take much more blood than is ordinarily shed to choke the lungs, as has been suggested.

The patient, being often moribund before the operation is begun, may apparently die during its performance; but the tube having been inserted, recourse should be had to the various methods of artificial respiration, and even in the most desperate cases the surgeon's efforts may be crowned with success. In cases of diphtheria a quantity of false membrane may be found semi-detached in the trachea, and can be extracted with a pair of forceps or a feather with the best effect; but no surgeon is justified in imperilling his life by sucking out the windpipe in contagious cases. Mr. R. W. Parker's trachea aspirator (fig. 33) obviates this danger to the operator. It consists of a small glass or celluloid cylinder, to one end of which a soft catheter is fixed, and to the other a tube with a mouthpiece. The cylinder is loosely packed with some antiseptic wool, which effectually acts as a filter to prevent poisonous material reaching the operator's mouth. On an emergency an ordinary catheter might be employed,

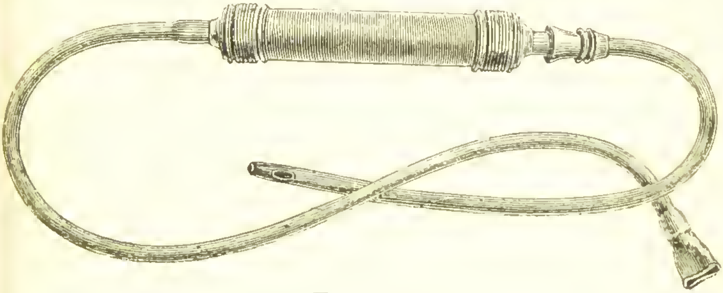


Fig. 33.

the operator covering the end in his mouth with two or three folds of silk handkerchief.

To secure the tracheotomy tube satisfactorily is not difficult, provided a sufficiently long and large tube be employed, so as to fit comfortably into the windpipe and afford the patient an abundant supply of air. The outer tube should be provided with a slit (not a hole) on each side of the flattened front portion ; and a tape long enough to go twice round the neck having been passed through one of the slits, both the ends are to be carried round the back of the neck, when one of them can be passed through the other slit, and the two tied in a bow at the side and quite out of the way of the tube (fig. 34). This is a better plan than that of knotting tapes on to the tube, which is apt to create an obstruction at the orifice.

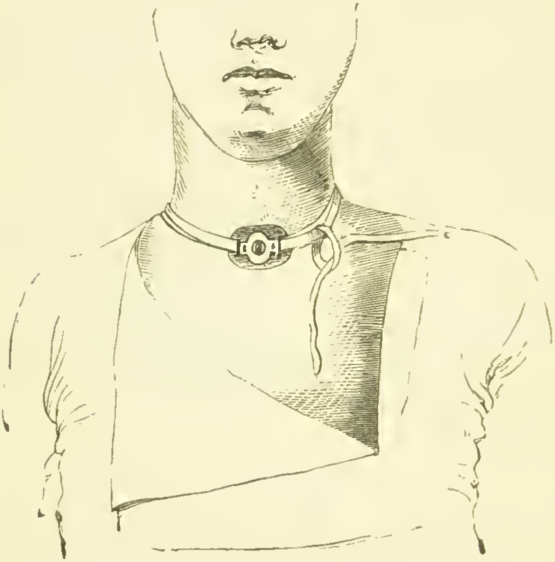


Fig. 34.

The after-treatment of a case of tracheotomy is of great importance, and consists in keeping the tube clear, preventing the access of cold air, and supporting the patient's strength. According to Mr. Pitts, the air of the room should be kept pure and at an even temperature of 65° ; above all, the bed should not be placed near a hot fire, with the spray from a kettle constantly playing over the face and body. A sponge kept warm and moist should be always over the tube, and the inner tube be changed every hour, or even oftener, whilst the discharges are thick. A great deal of harm may be done by a too zealous nurse, especially by the constant introduction of a feather to clear the tube, and by attempts to thus extract membrane from the trachea. If actual obstruction takes place, it is better for the surgeon to take the tracheotomy tube out altogether, and examine the trachea before replacing it.

When diphtheria membrane is present on the fauces or pharynx, the use of perchloride of mercury by means of a hand spray appears to be more beneficial than solutions of bicarbonate of soda, borax, or phosphate of soda.

At the Great Ormond Street Hospital a mercury solution, of the strength of 1 in 1000, has been employed by Dr. Collier in some seventy cases, without producing any signs of irritation or evidence of mercurialism. In using the hand spray it was found necessary to use a tongue depressor, because, however willing the patient was, the solution did not thoroughly reach the posterior pharyngeal wall unless the tongue was depressed. Each spraying procedure lasted from two to four minutes, including a pause for a few seconds at the end of each half-minute, and the quantity of solution used was about f ʒj. While membrane continued to be evident, the application was made every three hours ; it was then continued for a day or two, at intervals of six hours.

In cases of nasal diphtheria the nose was douched with warm boracic solution every three hours, and was sprayed with mercury solution after each douching.

The tracheotomy wounds were sprayed every two hours with the mercury solution, care being taken that none of the fluid entered the tube.

The collapsing tubes, spoken of above, facilitate the operation, and answer very well for cases where the tube is only retained for a few days; but if it has to be kept in the trachea for weeks or months, the old-fashioned double tube or the soft vulcanised india-rubber tubes recommended by Morrant Baker, and made by Maw, which are very comfortable to wear, are preferable, since granulations are apt to grow up between the edges of the divided tube and thus become a source of constant annoyance. Another and more serious danger, arising from the use of rigid tubes for a length of time, is the production of ulceration of some part of the trachea, thus opening into the œsophagus or ulcerating into a large artery. In order to obviate this danger Parker has introduced an angular tube (fig. 35), which he recommends should be as short as is compatible with safety.

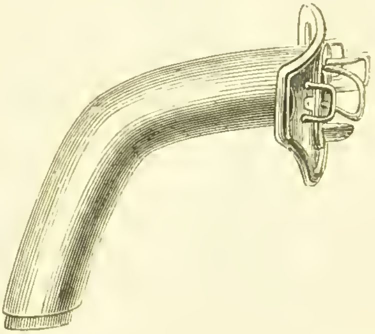


FIG. 35.

Durham also devised a form of tube which meets the evil. Instead of the whole tube being more or less curved, as in the ordinary form, only the extremity of this tube (fig. 36) is curved, and the length of the straight portion A can be adapted to each case by means of the sliding collar B, which is fixed by turning the screw C. The collar is attached to a small plate, D, the extremities of which work in 'gimbals' on a neck-plate of the ordinary shape, E, thus securing a certain amount of play. The inner tube (fig. 37) has its extremity jointed like the tail of

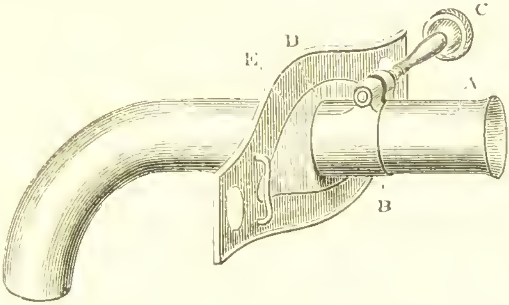


Fig. 36.

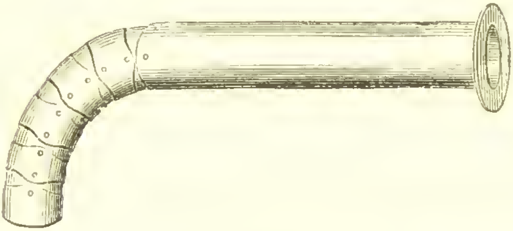


Fig. 37.

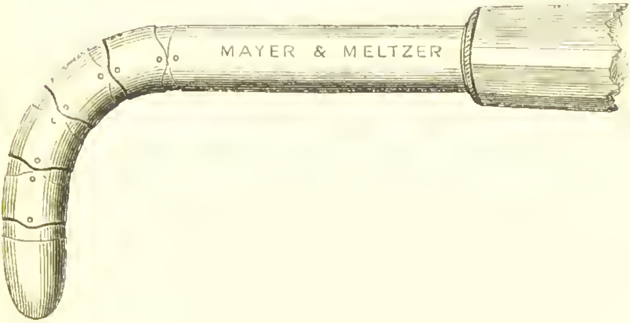


Fig. 38.

a lobster, in order that it may readily take the requisite curve. This tube is necessarily somewhat expensive, but when once the parts involved in the operation have resumed their ordinary condition, and the required length of tube has been ascertained, a simpler and cheaper tube on the same principle could be readily fitted.

In introducing this or any form of cylindrical tube into the trachea, it will be found that a blunt-pointed pilot trocar (fig. 38), made on the same principle as the inner tube (or in tubes of the ordinary curve made simply of lead), will much facilitate the operation. The handle, which in the illustration is cut short, gives great control over the instrument.

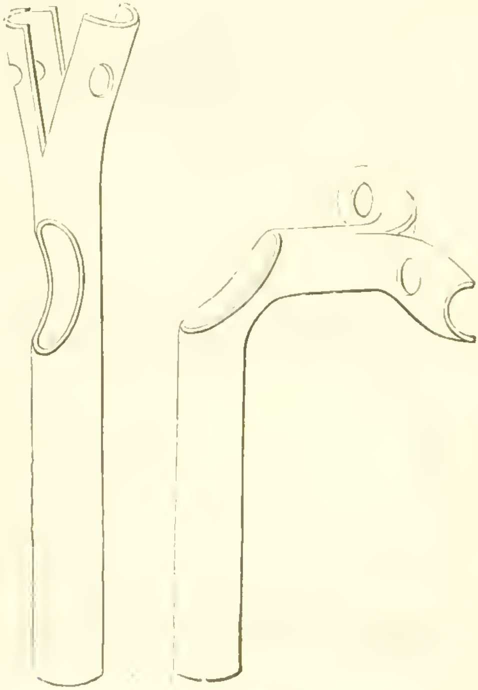


Fig. 39

Dr. E. B. Hastings has described (*British Medical Journal*, April 30, 1892) a simple and economical form of tracheotomy tube, which is shown in fig. 39. It can be easily made out of a piece of india-rubber drainage-tube in the following manner: An oval piece is cut out of one side of the tube, the shorter diameter of the oval reaching about halfway round the tube. Two longitudinal cuts are then made, one on the same side as the oval opening and the other opposite to it, reaching from the end of the tube to a point about a quarter of an inch from the opening; this distance will, however, vary with the depth of the wound that the tube is to be inserted into. In the lateral flaps made by these longitudinal incisions holes are cut for tapes. The piece of tube beyond the oval opening is the part which is put into the trachea, and it is advisable that it should be made rather longer than the vertical part of a metal tracheotomy tube usually is. In inserting the tube the opening must be turned towards the back of the trachea, so that it may take the place of the window which is found at the angle of many metal tracheotomy tubes; the part below the window then lies in the trachea without any tilting.

Intubation of the Larynx.—As an alternative to opening the trachea in laryngeal obstruction, *intubation of the larynx* with O'Dwyer's apparatus may be substituted. The instruments used are sold in sets consisting of five laryngeal tubes of different sizes (fig. 40), with an introducer, an extractor, and a gag. The tubes are made of brass, gold plated; they vary in length from 1½ to 2½ inches. A tube is elliptical in cross section, with an expanded head to rest on the vocal cords, and a fusiform enlargement in the middle of its length serving to retain it in the larynx; a thread passes through a small hole to one side of the head. Each tube is fitted with an obturator, closely filling the lumen of its tube, having a joint in the middle and a female screw in the upper end to attach it to the introducer. The introducer is a bar bent at a right angle at its further end and terminating in a male screw. Some of the modern instruments are fitted with a pair of claws, which can be made to slide over the end and push off the tube when introduced. The extractor is shaped like the intro-

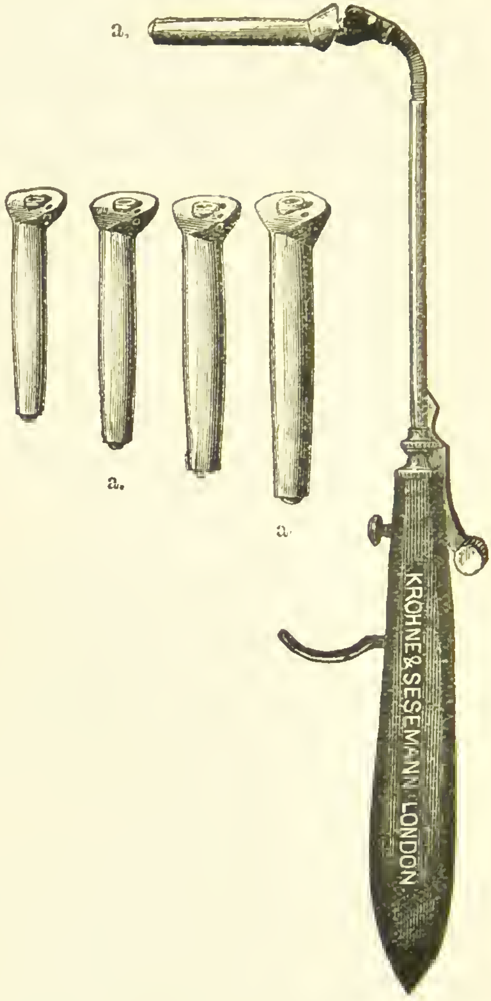


Fig. 40.

ducer, and consists of two blades which can be separated when in the opening of the tube.

Introduction.—A tube suited to the age of the patient being selected and the obturator screwed on to the introducer, the mouth is gagged open and the patient firmly held in the sitting posture. The left index finger is then passed over the epiglottis to the side of the aperture of the larynx. With the instrument held in the right hand and the thread round the little finger, the tube is passed to the back of the throat and guided to the glottis in the middle line; by elevating the handle of the introducer the tube is slipped through the glottis and passed on until the head rests on the vocal cords; the tube is then pushed off, and introducer and obturator withdrawn. A fit of coughing is the immediate result, but when this has subsided the thread may be cut and drawn out, care being taken that the tube is not displaced. In favourable cases the tube is extracted on the fifth or sixth day, and need not be replaced. The advantages claimed for this operation are that it is less severe than tracheotomy, and more likely to be sanctioned by the parents; that cold air is not admitted straight to the bronchi, and therefore that broncho-pneumonia is less likely to occur; that the return to normal respiration is more rapid. In children under two years of age, recovery after intubation is said to be more frequent than after tracheotomy. Against it, however, may be urged that the presence of the tube in the larynx keeps up irritation; that the diphtheria membrane may be pushed down in front of the tube; that asphyxia may result from blocking of the tube, or from its being coughed out in the absence of the medical man; and, lastly, that it has been known to cause deep ulceration of the trachea by pressure of its end.

Antitoxin Injections.—The use of special antitoxin injections in diphtheria, tetanus, and septicæmia is becoming generally adopted, and with satisfactory results. A special syringe (fig. 41), larger than an ordinary hypodermic syringe, should be employed, and the greatest care taken to render it and the skin of the patient aseptic. The preparations, particularly of the anti-diphtheritic preparation, vary considerably, and care must be taken that the patient is not over-dosed. A very good epitome of the whole subject will be found in Martindale's *Extra Pharmacopœia* (1895). The tetanus antitoxin is usually to be procured of Allen & Hanbury; the septicæmia antitoxin of Burroughes & Welcome (*v. British Med. J.* 12 September, 1896).

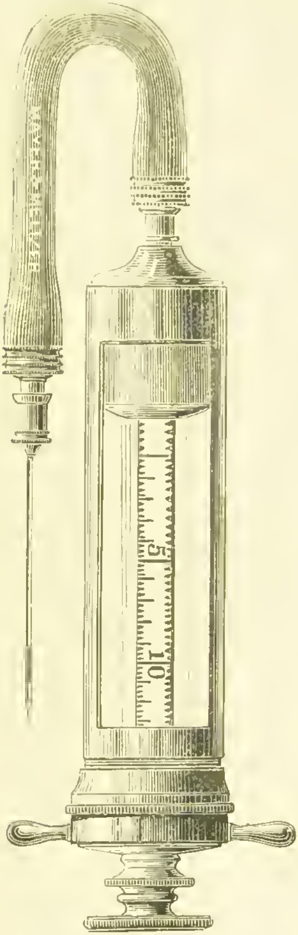


FIG. 41.

Paracentesis. —The house-surgeon may be called upon to perform *paracentesis abdominis*, or (more rarely) *thoracis*, in the medical wards. *Paracentesis abdominis* is best performed in the *linea alba*, and midway between the umbilicus and pubes. The operator should first satisfy himself that it is really a case of dropsy, and see that the bladder is empty. The patient being then brought to the edge of the bed, and placed on his side, a piece of mackintosh cloth should be arranged so as to protect the bed from getting wet, and the necessary pails, &c. should be provided to receive the fluid. With a sharp movement the surgeon thrusts in a trocar and cannula, receives the first gush of fluid in a bleeding-basin, and then conducts the stream into a pail, thus avoiding all the splashing which otherwise is pretty sure to occur. When all the fluid has been drawn, the wound can be closed with long strips of plaster, or a horsehair suture. A flannel roller should next be firmly applied round the abdomen, and the operation is completed.

The full-sized trocar formerly employed is unnecessarily large, and weakens the abdominal wall by the cicatrix it causes, besides evacuating the fluid so rapidly as to lead to faintness. A trocar of the size used for tapping a hydrocele, or the largest-sized needle of an aspirator, with an india-rubber tube attached, is quite large enough ; and if two are employed, they will evacuate an ascitic abdomen in from half an hour to an hour. The minute trocars introduced by Dr. Southey, which take several hours to evacuate a large quantity of fluid, have the drawback that their action is too slow to give marked relief in ascites, and that the fluid is reproduced almost as rapidly as it is evacuated ; but they answer admirably for the relief of anasarca.

Paracentesis thoracis is usually performed in the space between the seventh and eighth ribs, midway in the axilla or at the angle of the scapula, and the object of the surgeon is to enter the trocar or aspirator needle at the *upper* border of a rib, so as to avoid all possible risk of wounding the intercostal artery.

Should the fluid drawn off prove to be purulent, constituting an empyema, it will almost certainly reaccumulate, in which case it will be advisable to make a free opening for its exit. The aspirator needle being withdrawn, a steel director may be conveniently pushed through the puncture and between the ribs until pus appears along the groove of the instrument, when a blunt-pointed bistoury can be slipped along it and made to enlarge the opening sufficiently to introduce a flanged drainage-tube, or a loop of smaller tube.

In children, and also occasionally in adults, it will be advisable to remove from 1 to $1\frac{1}{2}$ inch of the lower rib in order to give room for the drainage-tube. The incision must be correspondingly enlarged, and the periosteal elevator used to strip the rib on both surfaces, the section being made with sharp bone-forceps.

Any immediate washing out of the pleura is to be deprecated, as being not without danger, though later on antiseptic injections may be required.

Aspiration.—The pneumatic aspirator of Dieulafoy and its various modifications are now in common use for the diagnosis and evacuation of collections of fluid in various parts of the body. The exhausting syringe is a feature common to all the instruments, but the best form is that which admits of a reversal of the current so as to clear the needle of any accidental obstruction during the withdrawal of the fluid. This is of course impossible in the various forms of 'bottle aspirator.' In using the aspirator it is essential that the needle and tube employed should be perfectly clean, and this fact is best ascertained by pumping carbolised water through the entire apparatus on each occasion of its being employed. The tap communicating with the hollow needle being then reversed, and a vacuum formed behind it, the needle, previously dipped in carbolic oil, is to be carefully thrust with a twisting motion into the part to be explored, care being taken to avoid the position of main vessels and nerves. Continuity being then restored by turning the tap, the fluid contained in any cavity which may have been reached will flow into the syringe or reservoir, and, if at a greater depth than anticipated, may be carefully sought for with the needle which now forms part of the vacuum. When all the fluid present has been extracted by the pumping action of the syringe, or, in the case of large collections, by simply converting the tube into a siphon, the needle is to be withdrawn and the minute aperture in the skin covered with a piece of wool dipped in collodion.

Venesection.—A tape is to be carried twice round the arm a few inches above the elbow, and tied in a bow. The veins being thus obstructed and made prominent, the operator is to choose the one he intends to open, remembering that while the median-cephalic is the safer, the median-basilic is generally the larger, and therefore yields a better supply of blood, but has the disadvantage of lying directly over the brachial artery. Standing in front of the patient and grasping the arm with the left hand, the thumb of which serves to steady the vein and prevent a premature flow of blood (fig. 42), the surgeon, holding the lancet as shown in fig. 43, with a sweep of the wrist makes an oblique

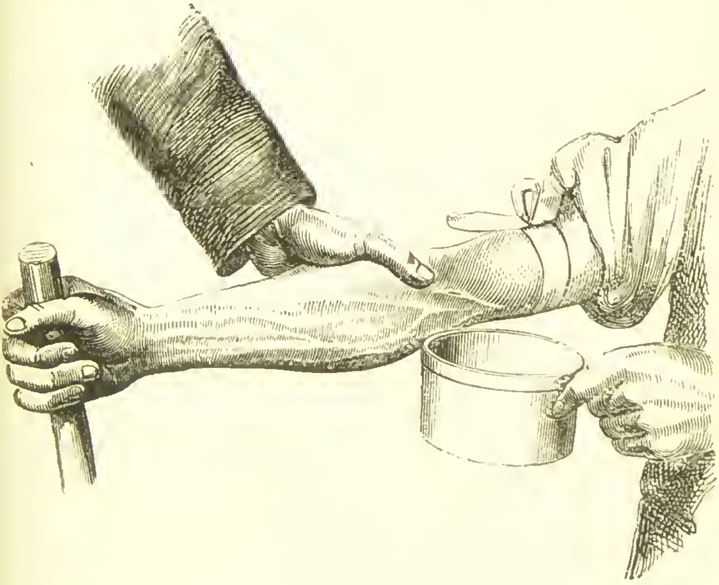


Fig. 42.

incision (not merely a puncture) into the selected vein, taking especial care not to go through it. The pressure of the thumb being relaxed, the stream may be directed into a bleeding basin, and not a drop of blood ought to go on the floor or on the dress of the patient. If the blood does not flow readily, the patient may have recourse to the common plan of forcibly grasping a stick and moving the fingers about. When the required amount of blood has been abstracted, the tape is to be untied, and a pad of lint is to be

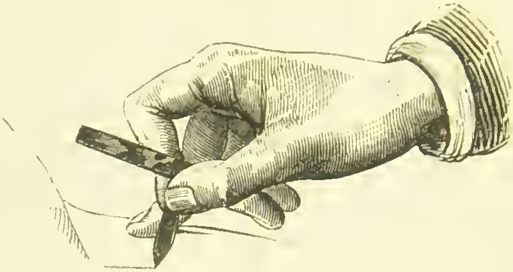


FIG. 43.

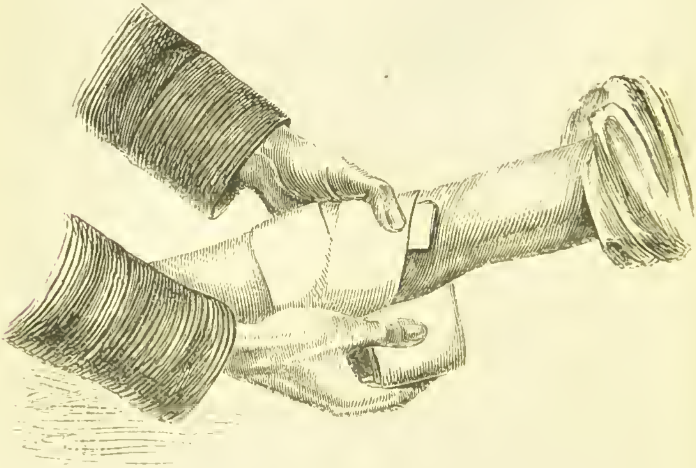


FIG. 44.

placed upon the wound, and maintained in position with the left thumb of the operator, while a bandage is applied. This is done by making a turn round the arm below the joint, then going over the pad to above the joint (fig. 44), making another turn round the arm at this point, and, lastly, returning across the pad. Or the tape which was bound round the limb may be employed, the middle of it being crossed over the pad obliquely, and the two ends carried round the arm in opposite directions, above and below the elbow, until they meet obliquely over the pad. They are then to be twisted round one another, and passing straight round the arm are to be tied in a bow on the outer side of the limb (fig. 45).

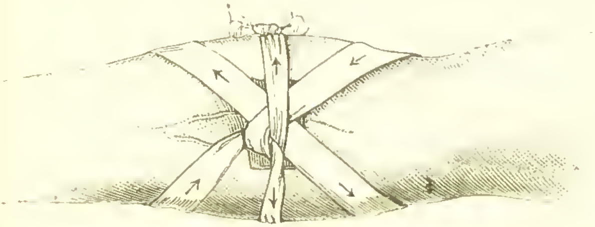


FIG. 45.

Bleeding from the jugular vein is rarely employed, but is performed in the following way. The left thumb of the operator is to be placed on the vein immediately above the clavicle, so as to obstruct the course of the blood. As soon as the vein is prominent the lancet can be used, taking care that the incision is made parallel to the *sterno-mastoid* muscle, and thus somewhat across the vein. When sufficient blood has been drawn, a pad is to be placed on the orifice, and a bandage to be applied over it and under the axilla of the opposite side; but the thumb must not be removed until the whole arrangement is completed, lest air should gain entrance into the vein.

Bleeding from the temporal artery is still more rarely performed, and consists in selecting the anterior branch of the temporal artery, and then making an incision across it—not so deeply, however, as to divide it. In order to arrest the hæmorrhage and prevent the formation of a false aneurism, the lancet must be made to *divide* the artery thoroughly, and a pad must be firmly bandaged over the wound.

Transfusion may be necessary in Uræmia, or after extensive loss of blood.

The direct transfusion of blood from a healthy person to the patient is now rarely employed, and has been replaced by the injection of a saline solution. The solution used at University College Hospital is made as follows :—One drachm of sodium chloride is added to each pint of boiled water at a temperature of about 104° F. A bottle containing two pints is filled with this solution. The cork is perforated by three holes : one for a thistle-headed replenishing tube ; one for a thermometer ; and one for the delivery-tube, which last is of india-rubber, terminating in a vulcanite cannula. Thirty ounces should be injected at a time, by siphon action. The most prominent vein at the bend of the elbow is exposed and three ligatures are passed round it. The lower one is tied at once ; the cannula is then inserted into a slit in the vein and tied in by the second ligature; after sufficient fluid has been injected, the upper ligature (above the opening) is tied and the cannula withdrawn. The little wound is closed with a stitch.[1]

Incisions into inflamed parts.—Incisions may be necessary in carbuncle, erysipelas, &c., and they require care in their performance. An incision into a carbuncle, to do any good, must go right through it to the fascia beneath, and through the whole extent of brawny tissue (though carbuncle may often be more satisfactorily treated by a series of subcutaneous sections); whether the incision shall be made crucial or not will depend upon the extent of the disease. Incisions in erysipelas, &c., should as a rule be made in the length of the limb, and not across it, and must divide the whole thickness of the cutis, since otherwise no relief is given to the tension. No fixed rule can be laid down for the length of the incision, but it is better to make two or three small ones than one large 'gash' for the whole length of the limb.

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[1] See Dr. Spencer, *Lancet*, i. 1892.

In the case of all incisions, unless it is intended to abstract blood from the part, care should be taken to arrest the flow of blood thoroughly before any warm fomentation or poultice is applied. This is most easily accomplished by placing strips of dry lint or gauze in the incisions and elevating the limb, or, if necessary, by applying in addition a bandage over the pad for an hour or two. The pledgets of lint or gauze should not be removed until they separate spontaneously.

Abscesses frequently come under the house-surgeon's sole care, and he must open them on his own responsibility. In making a diagnosis of the presence of matter in a limb, the house-surgeon will do well to bear in mind one constant source of fallacy—viz. the sense of fluctuation imparted to the fingers by the fibres of the superficial muscles. This error is easily avoided by remembering (as any one can prove on his own thigh at any time) that although pressure from *side to side* of a healthy limb will give a very exact imitation of fluctuation, yet that if the pressure be made *in the length* of the limb or muscle, no such sensation will be produced. If deep-seated matter be suspected but cannot be satisfactorily made out, the grooved needle, or a fine trocar and cannula, may be used to explore, and a bead of matter being thus evacuated will render the diagnosis certain. If the matter be too thick to flow readily, a small quantity will generally be discovered by blowing through the cannula after withdrawal. The modern 'aspirator' will not only facilitate the diagnosis of matter, but will in many cases afford the best treatment of the abscess, which may be thus tapped more than once, if necessary, before being laid open.

In opening all abscesses, care should be taken to cut parallel to, and not across, important structures ; thus abscesses in the limbs are opened by a longitudinal incision, and in the breast in a direction radiating from the nipple. Wherever it is possible the opening should be dependent, and in treating deep abscesses among important structures, as in the axilla, the house-surgeon may do well to avail himself of the method suggested by Hilton—viz. to make a small incision in the skin, and then to thrust a director between the important parts to the abscess, which will be shown to have been reached by the escape of a small quantity of pus. A pair of ordinary dressing-forceps can next be introduced along the director, and be opened so as to widen the aperture and give free exit to the matter.

Having made up his mind as to the existence of matter, and having begun to seek it, the house-surgeon should not be dismayed at having to cut occasionally considerably deeper for it than might *primâ facie* have been expected, but should persevere in a careful incision until the abscess is reached.

In order to receive the matter from an abscess without soiling the patient's clothes, the house-surgeon should be provided with kidney-shaped bowls or triangular trays of different sizes (figs. 46 and 47), which may be conveniently held against the part operated on. Since the abscess is to be opened antiseptically, the bowl must be carefully washed in a 5-per-cent. solution of carbolic acid before being used.

If a part be highly inflamed and the formation of pus seems impending, this may often be averted by smearing the part with a mixture of Extract of Belladonna one part, water one part, and Glycerine three parts, and covering it with a linseed-meal poultice or a fomentation.

When pus has formed, the abscess must be opened in all cases with antiseptic precautions. The best dressing after opening an acute abscess is a boracic fomentation. Chronic abscesses should be scraped with a Volkmann's sharp spoon, and the lining membrane wiped out with a strong antiseptic (carbolic acid 1–20) applied on a piece of sponge held in forceps. If an abscess be aspirated, it may sometimes be prevented from refilling by washing it out with carbolic acid lotion 1–20 through the aspirator; this generally causes it to fill again with serum, which is gradually absorbed.

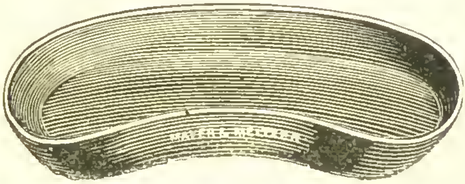

FIG. 46.

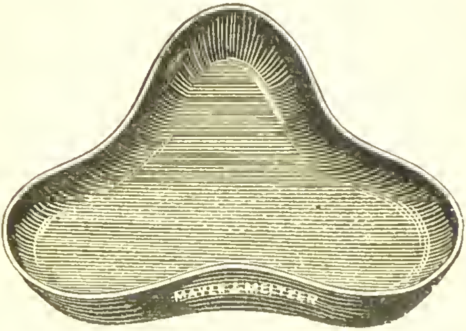

FIG. 47.

A *sinus* may be left after an abscess has been opened: this will sometimes close after stimulation with nitrate of silver; but if it be due to imperfect drainage the opening should be dilated, the sinus scraped with a sharp spoon, and wiped out with carbolic acid lotion 1–20, and a drainage-tube inserted.

Whitlows constantly require incision, and the following may be usefully borne in mind. The sheath of the tendons extends only to the base of the ungual phalanx of each finger, and hence matter in the soft pulp at the extremity, or round the nail, never finds its way up to the palm, and only a very limited incision, therefore, can be required for its evacuation. Matter in other parts of the finger, on the contrary, is sometimes within the sheath, and, unless it is evacuated by a timely incision, will creep up into the palm, and do irreparable mischief. The proper place for making an incision in these cases is over the head of the metacarpal bone, and the sheath should not be extensively slit up, or the tendons will certainly slough. The incision should be strictly in the middle line of the finger, so as to avoid injuring the vessels and nerves at the side.

In opening abscesses in the palm of the hand, it should be borne in mind that the position of the superficial palmar arch is tolerably well indicated by the middle crease or groove in the skin of the palm, and that the bifurcation of the digital arteries is about midway between the front line and the roots of the fingers.

The hot arm-bath is the most comfortable application after a whitlow is incised, and should be in readiness. The arm being laid in it, a mackintosh cloth or blanket should be laid over to keep in the heat, and fresh hot water should be added occasionally. The inflammatory blush above the actual seat of the mischief is best treated by the application of Extract of Belladonna and Glycerine in equal parts.

When matter has formed in the palm of the hand, troublesome adhesions are frequently left. Early in the case the fingers should be systematically bent, but often it is necessary, when healing has taken place, to administer an anæsthetic and forcibly move the finger so as to break the adhesions down. This is followed by some inflammation, which should be allayed by evaporating lotion. Frequent movement is necessary afterwards, as there is a great tendency for the adhesions to re-form.

Introduction of eye-drops.—This little operation is constantly required, and demands some care for its effective performance. It is essential that the fluid should be applied to the whole of the conjunctival surface; and for this purpose, the patient being seated with the head thrown a little back, the operator should gently separate the lids with the forefinger and thumb of the left hand, and apply the drop to the *outer* angle of the eye, taking care that it passes between the lids, and not outside them. To apply the drop, a camel's-hair brush, or better, the little spoon contained in every pocket-case, may be employed; but the neatest and most convenient method of introducing eye-drops is to keep them in little bottles, the stoppers of which are pierced with a capillary tube which is covered with a glass cap when not in use. Being kept not more than half full, it is only necessary to grasp the bottle, when the heat of the hand will be sufficient to

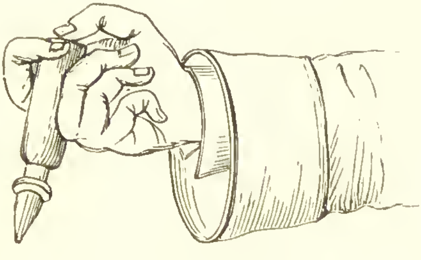

Fig. 48.

expel a drop of the contents. The form of the bottle and a convenient mode of holding are shown in fig. 48. In using it the eyelids need not be widely separated; it is sufficient to introduce the apex of the conical stopper between the lids near the outer canthus, so that the fluid may follow the course of the tears, and sweep across the globe.

Plugging the nares.—The anterior nares may be plugged with strips of lint coated with vaseline, and if these are pushed as far backwards towards the pharynx as possible, and the whole cavity of the nose is filled with lint introduced bit by bit, the more complicated operation upon the posterior nares will be but seldom required. For plugging the posterior nares, most hospitals are provided with a 'Belloc's sound'—*i.e.* a piece of watch-spring with a ring at the end, enclosed in a cannula; but if this is not at hand, an ordinary elastic catheter (No. 4 or 5) will answer every purpose. It is advisable that the end should be cut off the catheter and a double thread carried through it (which can be easily accomplished by the aid of a stilette), so that a loop may hang out of the cut extremity. It will facilitate the catching of the thread in the fauces if a knot be tied in the thread about two inches from the loop, which will have the effect both of preventing its receding into the catheter, and also of causing it to project more into the mouth. If Belloc's sound is used, the thread will be passed through the ring simply, or a knot and loop may be formed as above recommended. The sound being passed along the floor of the nose, the loop must be made to project in the fauces, when it is seized with forceps and drawn out of the mouth, the cannula being afterwards withdrawn from the nose (fig. 49). A roll of lint (which is better than sponge) being attached, can now be easily drawn up into the posterior nares, guided behind the soft palate by the forefinger. The ends of the thread are then to be tied, close to the nostril, round another roll of lint, which serves the double purpose of keeping the plug firm and of obstructing the anterior nares. When all danger of hæmorrhage has ceased, the posterior plug may be removed by a stream of water from a syringe, or by gentle pressure with a bougie through the nose.

It has been advised by some writers to attach strings to the posterior pad, which the patient is to swallow until they are required for its dislodgment; but if this is done it is better to bring the strings loosely out of the mouth and secure them in front, though this is rather uncomfortable for the patient.

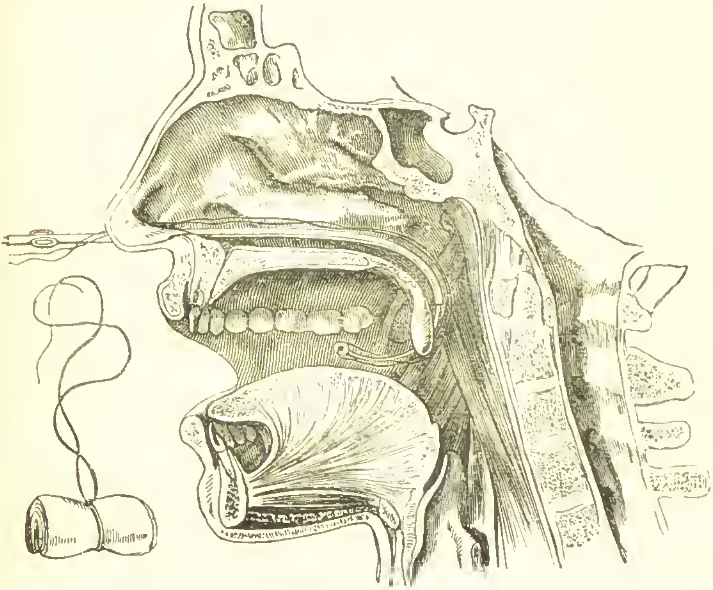

Fig. 49.

Howard's epistaxis plug (fig. 50) is a convenient instrument for plugging the nares, and consists of a thin india-rubber bag, which can be introduced into the nose by means of a probe, and then be inflated with an air-ball so as to exert the necessary pressure.

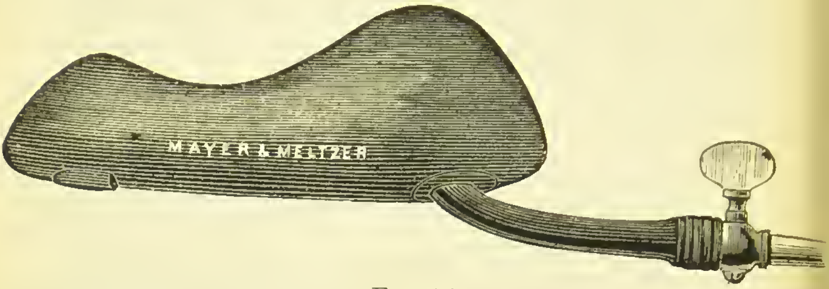

FIG. 50.

It has the advantage of cleanliness and of ready withdrawal when done with.

Removal of nasal polypus.—The presence of an ordinary gelatinous polypus being ascertained by an inspection of the obstructed nostril, when a glistening, yellowish body will be perceived, the forefinger of the left hand should be passed behind the soft palate to ascertain the presence of polypi in the pharynx and to assist in their removal. A slender pair of polypus-forceps or a wire snare being now introduced with the right hand, the polypi can be grasped and rapidly twisted out, the left forefinger guiding the instrument to the growths, which commonly obstruct the posterior nares. In this way the polypi are thoroughly removed instead of being 'nibbled at,' and the forefinger both keeps the patient steady and prevents the passage of blood into the throat, but is liable to be bitten unless protected with a piece of india-rubber tubing. The polypus-forceps in ordinary use are much too large and clumsy, and the blades are serrated only at the ends instead of in their whole length, as they should be.

In this and the following operations on the throat it is well to dull the pain by applying a solution of hydrochlorate of cocaine (5–20 per cent.), either with a camel's-hair brush, or with the small spray contrived by Dr. R. S. Miller (fig. 51).

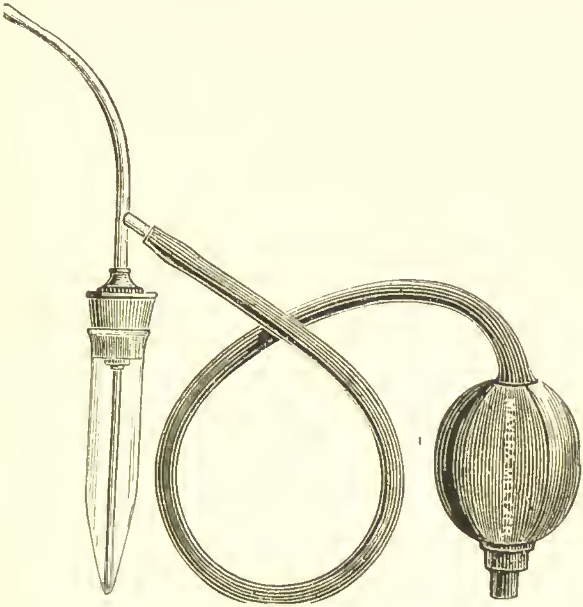

Fig. 51.

Puncture of tonsil.—An inflamed tonsil may be seen partly projecting towards the opposite side, and partly forming a tumour behind the anterior pillar of the soft palate, and it is in the latter situation that a puncture should be made. A sharp-pointed bistoury should be covered with lint to within three-quarters of an inch from the point, with the view of both avoiding injury to the lips and of limiting the depth of the incision. The mouth being open and the tongue depressed, the point is to be carried *straight back*, and thrust through the palate into the most prominent part of the tumour. The edge of the bistoury being upwards, the puncture can be readily enlarged to give exit to matter, if it has formed, as it generally does, in the upper part of the gland. The incision in the palate is not of the slightest moment, and heals readily. The hæmorrhage, which is sometimes sharp for a few minutes, is from the palatine and ascending pharyngeal arteries, and never from the internal carotid, and will be easily arrested by the use of cold water. (See also p. 30.)

Removal of tonsil.—The house-surgeon should be prepared to perform this operation if called upon to do so, and will find the hooked forceps and bistoury, or the simple instrument shown in fig. 52, as efficient as the complicated 'guillotines,' which are always getting out of order, and require the attention of the instrument-maker after each time of using.

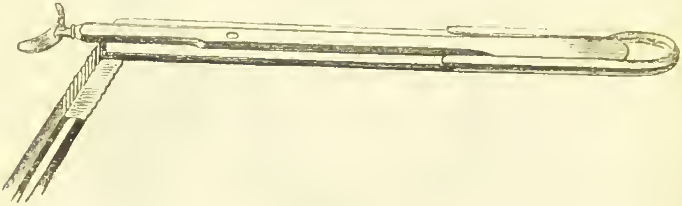

Fig. 52.

The curved probe-pointed bistoury should have the heel covered with a piece of lint, and is to be held in the right hand, while the forceps occupy the left. The patient's head being thrown a little back and the mouth opened, the enlarged tonsil can be grasped; and if it is on the left side, the surgeon will have no difficulty in passing the bistoury below it, and slicing it off, while standing in front of the patient. If, however, it is the right tonsil, in order to operate without changing hands the surgeon should stand on the patient's right, and, leaning over him, will be able to use both knife and forceps efficiently.

The simple guillotine (fig. 52) is more convenient for children and unsteady patients, because it thoroughly gags the mouth when once fairly introduced. In order to use it effectively, the assistant holding the patient's head should press up the tonsil by making pressure immediately behind the angle of the jaw, or, when very large tonsils have to be dealt with, the operator should be provided with a pair of hooked forceps to draw the tonsil well through the ring of the instrument, or an insufficient portion will be removed. The ring of the guillotine should be passed below the tonsil by raising the handle, so as to make sure of enclosing the pharyngeal or lower portion. The operator should stand in front of the patient, holding the guillotine in the right or left hand, according to the side to be operated on, and, if both tonsils are to be removed, should turn the guillotine in the mouth, without removing it, so as to prevent closure of the jaws by the patient.

Adenoid vegetations in the naso-pharynx frequently accompany enlarged tonsils, giving rise to obstructed nasal respiration and to deafness from Eustachian obstruction.

In slight cases, the hypertrophied lymphoid tissue may be scratched away with the nail of the first finger introduced behind the soft palate; but in the majority of cases it is more satisfactory to administer chloroform, and to scrape away the growths with a Gottstein's curved curette. Blood and fragments are best prevented from entering the air-passages by hanging the head over the end of the table.

The after-treatment consists in washing out the naso-pharynx with a nasal douche of sanitas once or twice a day, and careful avoidance of cold.

Tooth extraction.—The house-surgeon should be provided with six pairs of tooth-forceps, with which he should be careful to extract '*the* tooth, the whole tooth, and nothing but the tooth.' For *upper incisors, canines*, and *bicuspids*, the straight forceps (fig. 53) should be carefully pushed up into the socket until the tooth is loosened, and can be extracted with a slight twist. For *lower incisors* and *canines* a similar instrument with the blades curved (fig. 54) is useful, or the hawk's-bill forceps (fig. 55), which is specially meant for the *lower bicuspids*, may be employed. For the *lower molars*, which have two fangs, one forceps with divided blades (fig. 56) is sufficient, or the hawk's-bill forceps may be employed. The upper molars have three fangs, two on the outer or buccal, and one on the inner or palatal side, and hence a right (fig. 57) and left (fig. 58) forceps is required, having a sharp projection to fit between the outer fangs, and with a smooth blade for the inner side. In using molar forceps, the instrument must be pushed well home and then worked gently from side

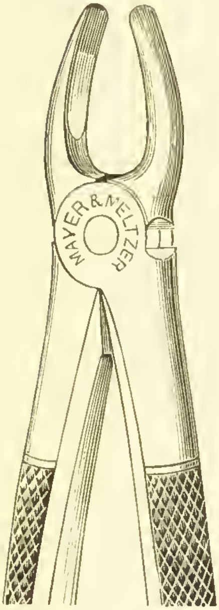

Fig. 53.

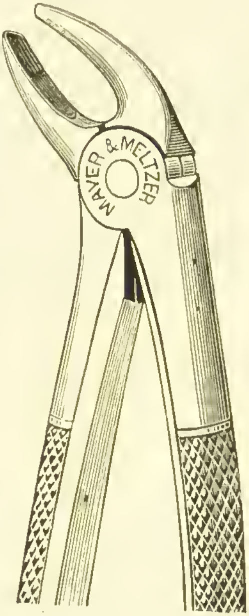

Fig. 54.

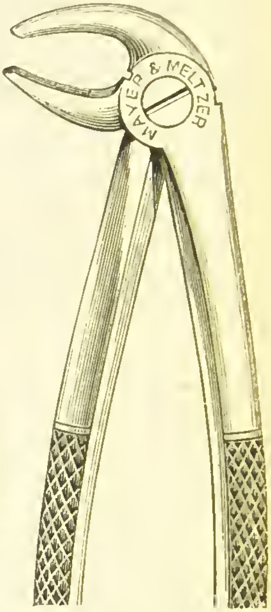

Fig. 55.

to side in order to loosen the tooth, and in some cases a slight fracture of the outer edge of the alveolus is unavoidable, and is practically of no consequence.

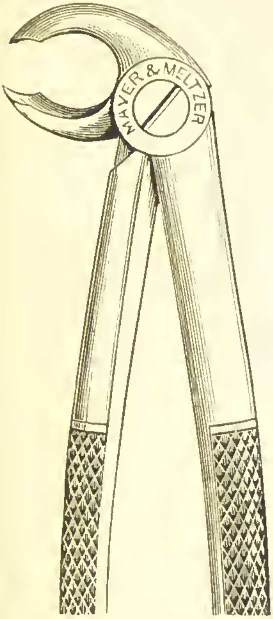

Fig. 56.

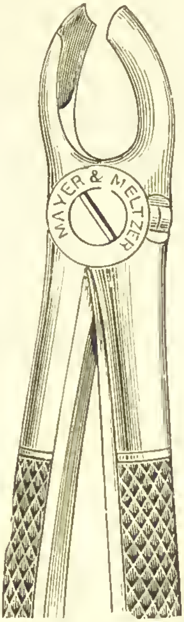

Fig. 57.

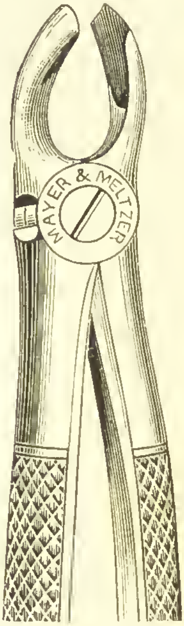

Fig. 58.

The Spray producer is a very useful little instrument for applying remedies locally, both in the throat

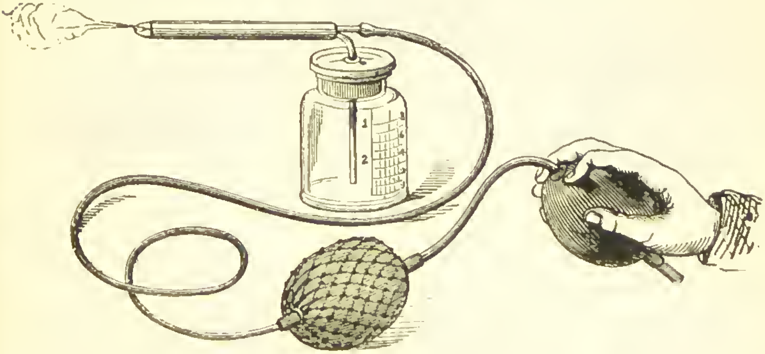

Fig. 59.

and nose. Fig. 59 shows one of the forms in common use, consisting of an india-rubber hand-ball and reservoir, by which air is driven through a double capillary tube communicating with the fluid in the graduated bottle, which is thus projected in the form of spray. The tubes may be of glass, or better, vulcanite, and are made of various shapes, to suit the larynx, nose, &c.

Paquelin's Thermo-cautère.—This is a most useful instrument, supplying the surgeon with an actual cautery available in a few minutes. It consists (fig. 60)

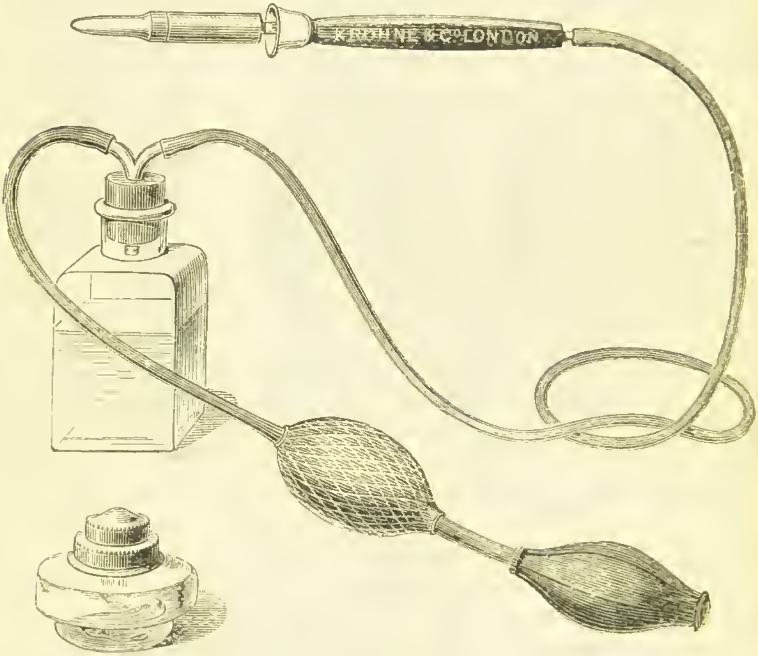

FIG. 60.

of platinum points, of various shapes and sizes, which can be made hot in the flame of the spirit-lamp, and be kept at any required heat by blowing the vapour of common benzole through the instrument, with a hand-ball similar to that attached to a spray-producer In using the cautery it is necessary to hold the point in the flame of the spirit-lamp until it is thoroughly heated, when a few gentle whiffs of benzole will render the metal incandescent, and it can be kept so by occasionally working the bellows. For arresting hæmorrhage the platinum should be only of a dull red heat, whilst for cutting through tissues it should be blown up to a white heat. Caution must be used in bringing the cautery near the mouth of a patient inhaling ether, lest an explosion should occur.

Galvano-cautery.—The heat is produced by passing an electric current through platinum wire. The current may be obtained from a bichromate of potash battery, but hospitals should be provided with an electric accumulator. The platinum wires are fixed in an insulated handle, having a movable button by means of which connection can be made and broken.

Local anæsthesia may be produced by freezing the skin with an apparatus similar to the spray-producer, but employing highly rectified ether, as proposed by Richardson. The effect of the 'ether-spray,' when played upon the surface, is to blanch and harden it, and incisions may then be made with very little pain. The drawbacks to the use of this anæsthetic are, that the subcutaneous tissues are not affected, whilst the skin itself is rendered so hard that it is difficult to operate on it. The pain produced by the freezing and thawing of the part is also considerable, and more than counterbalances the advantages claimed for the method. In using the ether-spray at night the greatest care must be taken to avoid the too close proximity of a naked light, as the vapour given off is highly inflammable.

Methyl chloride, ethyl chloride, and a mixture of the two drugs known as Anestile and Coryl, are largely used by dentists and for small operations. The fluid is supplied in glass tubes with a metal cap, on the removal of which a spray is produced by the warmth of the hand. The action of all these drugs is the same as of the ether-spray.

Amputation of fingers.—In cases of crushed fingers or gunshot injuries, it may be necessary for the house-surgeon to amputate a finger, but he should always avoid doing so if there is a probability of the member becoming serviceable by care and attention. Amputations at the joints are generally necessary, and are more easily performed there than in the length of a phalanx.

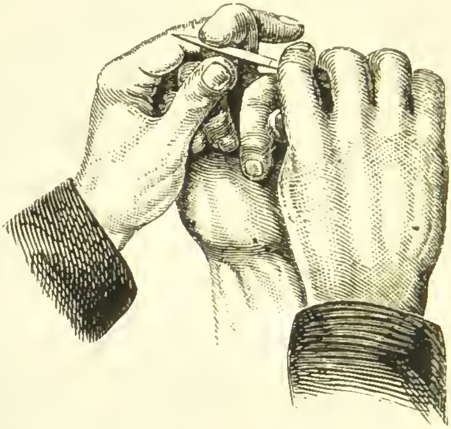

FIG. 61.

To amputate the third or second phalanx.—Grasp the phalanx firmly by means of a piece of lint, and bend it as nearly to a right angle with the next bone as possible. Place the heel of a narrow scalpel or bistoury at the side of the joint, exactly midway in the thickness of the next phalanx (fig. 61), and draw the knife horizontally across the joint, which will fly open at once if the lateral ligaments have been thoroughly divided with the point and heel of the knife. Pass the knife through the joint, and cut a flap from the palmar surface of the phalanx. Probably no vessel will require a ligature, and the flap may be retained in its place with a couple of stitches and a strip of gauze or lint.

It should be remembered that if the first phalanx alone be left it will always be unsightly, owing to its having no tendon to flex it; and therefore, if possible, a part of the second phalanx should be left by making a small dorsal and a larger palmar flap about the middle of the phalanx, and cutting through it with the bone-forceps. If this is not practicable, it is a good plan to stitch the tendons to the flaps so as to give, if possible, movement to the phalanx.

To amputate the first phalanx.—In doing this operation, the head of the metacarpal bone may be removed or not, according to the taste of the operator and occupation of the patient. The oval amputation (fig. 62) is generally the best, and is performed by placing the point of the bistoury on the metacarpal bone near its middle, cutting along it to the joint, and then passing in an oval sweep just below the joint so as to obtain sufficient flap. The flaps are then to be dissected back, without opening the joint, and the head of the metacarpal bone and a portion of the shaft are to be cleared of muscular fibre, when the cutting-forceps can be applied to the bone, and the finger at once removed. The incision will, if properly

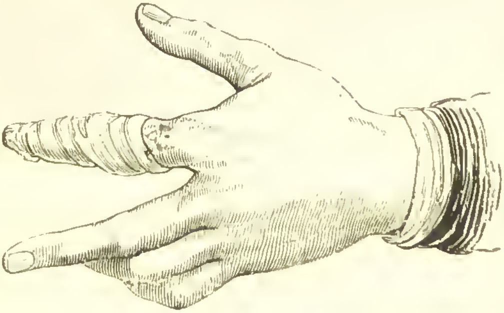

Fig. 62.

made, form a single line when the edges are brought together.

The position of the incision will vary slightly in the several fingers: thus, in the forefinger it should be placed as much on the outside of the metacarpal bone as possible, so that the scar may be hidden, and, for the same reason, on the inner side of the little finger. In the middle and ring fingers the incision is unavoidably on the back of the hand.

In removing the first phalanx of the *thumb* the head of the metacarpal bone should be invariably left, since *any* thumb is better than none. With this view the incision should be brought well over the base of the phalanx, and taken almost circularly around it, so as to obtain flap enough to cover the head of the metacarpal bone, which is larger than one would *primâ facie* expect to find it (fig. 63).

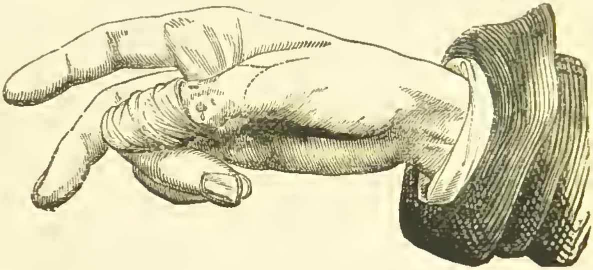

Fig. 63.

This method may also be adopted in the fingers when it is desired to leave the heads of the metacarpal bones.

Amputation of toes.—This is generally a very simple matter, the crushed portions being removed and the flaps made in any way most convenient; and if there is not sufficient skin, the parts will granulate and cicatrise over without difficulty. The only caution necessary is, never to remove any of the metatarsal bone, nor in fact to open the metatarso-phalangeal joint if it can be avoided, since the foot is thereby considerably weakened, and matter is very apt to find its way into the sole of the foot. It is better practice to cut through the first phalanx with the bone-forceps ; and it must be borne in mind that the metatarso-phalangeal joint, if it must be opened, will be found to lie much higher up than is generally supposed, and that it will be convenient to open the joint from below, the toe being drawn well up.

The use of the stomach-pump is most commonly required for the evacuation of poison from the stomach, but may also be needed in order to feed the patient. In either case it may be necessary to open the mouth forcibly ; and this is most readily accomplished by using the screw-gag, for if the extremity can once be insinuated between the teeth, no muscles can resist it. The jaws being separated, the common wooden gag (fig. 64), with a hole in the centre, can be tied in, and there will be no further obstacle. If the gag can be altogether dispensed with, as it mostly can, so much the better.

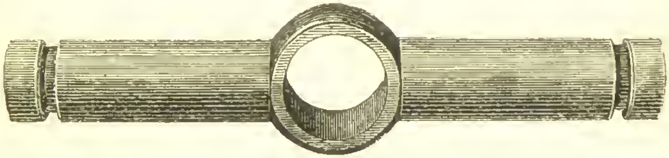

FIG. 64.

The best form of stomach-pump is that in which the direction of the current is controlled by a lever grasped with the left hand, the tap plainly showing in which direction the stream is passing. The instrument is fitted ordinarily with a stomach and a rectum tube, the former having the holes at the side and the latter at the extremity. Having oiled or, better, applied glycerine to the proper tube, the house-surgeon should curve its extremity rather abruptly, and introduce it carefully, through the gag, to the back of the throat. In order to do this, the patient's head is generally thrown back; but when the end of the tube is felt to have reached the back of the pharynx, the head should be bowed forward, or else the vertebræ project and prevent the tube passing down the gullet. A little gentle, steady pressure will make the tube glide down the pharynx until it reaches the back of the larynx, where there is often a slight hitch for a moment; but this is readily overcome, and the tube passes into the œsophagus and stomach. The direction in which the tube should be pushed is *upwards* rather than downwards; and if a proper curve has been given to the end of the instrument, and it be kept strictly in the median line, there will be no difficulty. With an ordinary-sized tube it is next to an impossibility to enter the trachea by mistake; but if the house-surgeon feel anxious about it, he can pass his finger down and make certain that the instrument is not in the larynx, which event would be immediately manifested by urgent dyspnœa.

Before attempting to withdraw any fluid from the stomach of the patient, some warm water should invariably be introduced, so as to avoid all risk to the mucous membrane, and then by a series of steady movements the contents may be withdrawn, care being always taken not to remove quite as much fluid as was thrown in; and if necessary the stomach may be washed out in this way several times. A good deal of trouble is sometimes experienced from the eyes of the tube getting choked with undigested vegetables, &c.; when this occurs, the action of the pump should be reversed immediately, so that the fragment may be driven out; or if this cannot be done, the tube must be removed, cleaned, and re-introduced. In cases where valuable time is being lost from this cause, it will be better to introduce an emetic through the pump and let it act in the ordinary way, taking care, however, that the patient, if insensible, is not suffocated by the vomited matters. In the case of young children a large elastic catheter forms the best tube, and this can be adapted to the pump by a piece of india-rubber tubing.

A simpler method of washing out the stomach, now often employed, is to use a siphon made of soft india-rubber tubing with a funnel attached (fig. 65). The tube being introduced, water is poured in by the funnel, which is then brought below the level of the stomach, the tube being pinched. A siphon-action is thus established, and the contents of the stomach flow out upon removing the pressure from the tube.

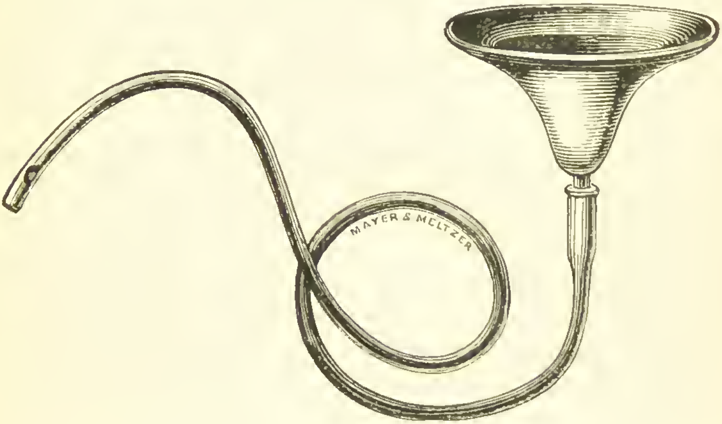

Fig. 65.

Introduction of rectum-tube and bougie.—Ordinary enemata are generally administered by the nurse; but in cases of obstruction or stricture of the rectum, the house-surgeon will be called upon to introduce the instrument. The long tube, commonly known as O'Byrne's, is to be introduced by the operator while standing behind the patient, who is placed on his left side. The house-surgeon's right forefinger, having been well soaped, is to guide the tube through the anus, and gentle pressure will then be sufficient in most cases to insure its passing through the intestine. Sometimes the tube catches in one of the transverse folds of mucous membrane of the rectum, and only bends upon itself; when it must be withdrawn, straightened, and re-introduced, the operator trying first one side and then the other of the intestine, so as to avoid the folds.

In the case of a strictured rectum it is best, if possible, to pass the forefinger up to the stricture, and thus guide the bougie or tube through the obstruction. When the stricture is high up, this is of course impossible, and careful manipulation with tentative injections must be trusted to alone.

If doubt is felt as to whether the long tube has passed the obstruction, the injection of warm water should be had recourse to, when, the ear being applied over the colon, the fluid will be distinctly heard passing along the bowel. When it is desired to distend the bowel steadily and slowly to its utmost limits, the siphon arrangement figured at page 25 will be found much more efficient than any form of enema syringe.

Rectal Abscess.—An abscess by the side of the rectum should be opened as early as possible in order to prevent the formation of fistula. The oiled forefinger (right or left according to the side to be operated on) having been passed into the bowel, a pointed curved bistoury should be plunged into the ischio-rectal fossa with the back of the knife towards the bowel, and a free opening made towards the tuber ischii. If the matter is extremely offensive, showing in all probability a communication with the bowel, it will be well before withdrawing the finger to use a probe, or, better, a probe-director, to ascertain the existence of an internal opening. If the probe-point of the director passed into the abscess meets the finger, the fistula is a complete one, and may be at once divided by hooking down the probe through the anus, at the same time pushing the director through the fistula. A little manipulation and stretching of the rectal tissues will then allow the director to be brought out at the anus, and a sharp-pointed bistoury can be run along it with great ease.

This is a more certain and easier method of dividing a *fistula in ano* than with a probe-pointed bistoury introduced through the fistula, and obviates the danger of breaking the knife in the fistula.

An inflamed pile at the verge of the anus often requires an early incision to prevent suppuration. It may be conveniently transfixed with a Syme's abscess-knife in the direction of the anal folds of skin. The little clot of blood almost always found in these superficial external piles should be gently squeezed out, and a poultice be applied.

Circumcision.—This operation is often entrusted to the house-surgeon, and may be done in various ways. The following is as satisfactory as any:—A piece of tape should be tied round the root of the penis, as this restrains all hæmorrhage. Grasping the end of the foreskin evenly with the finger and thumb, or better, with a pair of forceps, the operator then cuts it off obliquely from above downwards, so as not to interfere with the frænum, using either a pair of scissors or a bistoury, according to fancy. The cut skin now retracts, leaving the lining membrane of the prepuce still covering the glans. This membrane is then to be divided along the upper surface, nearly as far as the *corona glandis*, with the scissors, and the young operator must be careful that one blade does not slip by mistake into the urethra. The *glans* is now exposed, and care should be taken to tear through any adhesions which may have formed between it and the prepuce, particularly near the *corona*, so as to give exit to all the *smegma præputii* which will probably have collected. In an adult the margins of the skin and mucous membrane are now to be stitched together with interrupted sutures of the finest catgut; but in young children no stitches are really required, if care is taken to keep the foreskin back by dressing it in the following way:—A strip of dry lint eight inches long is used, and the middle of it is applied to the under-surface of the penis immediately behind the glans. The ends of the lint are then twisted round the penis firmly to the root, where they are either tied in a knot or are attached to the pubes with plaster.

A very convenient dressing for children, which has the advantage of being antiseptic, is to dust the part with iodoform, and use a strip of iodoform-wool to wrap around the glans penis. This can be thoroughly fixed with flexile collodion, which should also be painted around the glans to prevent the access of urine. The dressing may be left for a week or longer. Tinct. Benzoini Co. or Whitehead's varnish is sometimes preferred as being less irritating than the collodion.

The catgut sutures disappear without any trouble, but interrupted silk sutures are difficult to remove, and, if employed, very fine silk should be used, and the sutures should be tied so tightly as to cut their way out in a day or two. In cases where the prepuce of a child is only contracted and not too long, a cure can be effected by rapidly dilating the orifice with a pair of common dressing or polypus forceps. The prepuce should then be drawn back and kept so with water dressing for a couple of days, when it may be allowed to resume its usual position.

Tapping a hydrocele.—Before operating, even under orders, the house-surgeon should make sure of his diagnosis by examining the scrotum with a candle, so as to observe the translucency of the contained fluid. In order to do this satisfactorily, the candle should be held between the thigh, right or left, and the hydrocele, so as to be away from the penis; and the scrotum should be drawn tight with the fingers of one hand, while the other is used to shade the light. A wooden stethoscope or other tube may be conveniently used to look through, when the red glare will be at once perceived at the end of the tube, and the fallacy sometimes caused by the light showing through the fingers will be avoided.

In tapping a hydrocele it is convenient to sit in front of the standing patient, and, having grasped the scrotum with the left hand, to ascertain with the right that the testis is not accidentally in front of the fluid. The trocar and cannula may then be plunged boldly in with an upward direction, a point in the skin being chosen as free from veins as may be. The fluid being drawn off, a little collodion or a piece of plaster may be put over the puncture. In injecting a hydrocele, a syringe holding two drachms of the *tinctura* or *liquor iodi* should be employed, and the scrotum should be well manipulated after the injection, so as to bring the fluid in contact with the whole of the serous surface.

Ingrowing toe-nail.—This painful affection is best treated by the removal of a narrow strip of the nail, never the entire nail, with the scissors. Local or general anæsthesia having been induced (the nitrous oxide gas being especially useful for this and other short operations), the operator thrusts the narrow blade of a pair of angular surgical scissors beneath the nail near the side affected. This is forced completely up to the matrix and made to divide the nail, when the piece thus cut off is grasped with a pair of torsion-forceps as near the root as possible and twisted out. In long-standing cases of this affection, the nail has become so softened by the constant discharge that it is apt to break away and leave the root of the piece cut off *in situ.* The success of the operation depends, however, upon the evulsion of the entire depth of the nail, and an examination of the ragged edge of the piece removed will show how futile any less radical proceeding would be. In the rare cases of both sides of the nail growing in, a slip should be taken from each side, but the central portion should always be left intact. A little cotton-wool introduced by the side of the nail forms the best dressing at the time of the operation, and may be afterwards moistened with a stimulating lotion (sulphate of zinc or copper, two grains to the ounce of water).

Seton.—If only a single or double thread is to be introduced, the common needle will answer every purpose ; but if a larger seton is required, the seton-lancet may be used, or an ordinary bistoury and probe. The skin having been pinched up with the finger and thumb, the bistoury is thrust through the fold, and the probe carrying the seton is passed by its side ; the bistoury having then been removed, the seton can be drawn through and detached from the probe, when the ends should be fastened together to prevent its slipping out unawares.

When putting a seton into the temple (in eye affections) with an ordinary needle, the skin should be drawn up by the hairs scattered on it rather than by pinching, or the temporal artery may be transfixed.

Issue.—When an issue is to be made by the *potassa fusa*, a piece of leather plaster should be laid over the part, a hole having been cut at the point where the issue is to be formed. A small piece of the potash is then to be placed upon the skin, and secured in its position by a piece of strapping over it ; and in a few hours, when it has done its work, the strapping is to be removed, and the part carefully cleansed with vinegar and water, to prevent any portion of the caustic from passing beyond the intended boundary. If it is desired to maintain the discharge, a pea, or better, a large glass bead, may be fastened on to the ulcerated surface with plaster, and may in addition be smeared with savine ointment.

Cupping.—This operation requires a good deal of nicety in its performance, and is by no means so easy as it would appear. If the ordinary glass cups are used, it will be necessary to exhaust the air by means of the flame of the spirit-torch, or, as preferred by some surgeons, by inserting pieces of paper or cotton-wool dipped in spirit, and then setting them on fire in the cup itself. Whichever method is employed, care must be taken not to heat the glass too much, or the patient's skin will be scorched. When the cups are fitted with a little exhausting-syringe, the operation, though more tedious, is more easily performed.

Whether the cupping is to be 'dry' or 'wet,' the surface of the body should be sponged with warm water prior to the operation, and the cups be placed in a basin of boiling water before being used. The torch being then held beneath the cup, so that the flame enters it without touching the glass, the air becomes rarefied, and the cup should be immediately applied to the skin, and gently pressed on to it so that the surface may fit closely to its edges.

When the skin has risen well within the cup, it may be detached by introducing the nail beneath its edge, and the operation of dry cupping is completed. The scarificator used in wet cupping should be kept scrupulously clean, and its blades very sharp, and before commencing the operation they must be graduated to suit the thickness of the patient's skin, which can be best ascertained by pinching up a small piece between the finger and thumb. Care must be taken in the case of a fat patient not to set the blades too deeply, or they will cut through the skin and let the little pellets of fat protrude, effectually arresting the flow of blood. In using the scarificator, it must be pressed carefully against the skin, or it will slip and make very irregular incisions, and the freshly exhausted cup must be applied immediately over the cuts. Each time the cup is removed, with its contained blood, the surface should be wiped with a warm sponge, that all coagula may be removed from the incisions before it is replaced; and the cups should be plunged into hot water. A piece of dry lint, with a turn of bandage, will control all further bleeding when a sufficient quantity of blood has been abstracted. In cupping on the temple, after the cup is fixed, the lower edge should be a little elevated so as to take off pressure from the temporal artery beneath, or no blood will be obtained.

Leeches.—In order that leeches should bite freely, the skin to which they are to be applied should be thoroughly cleansed with warm soap and water, and then washed with milk. The leech, taken freshly out of water, should be held gently in a damp cloth against the skin until it adheres, or, if preferred, may be placed in a pill-box, which is to be pressed against the skin. When the required number of leeches are attached, they may be allowed to suck till they drop off, each leech being supposed to abstract three drachms of blood, but the quantity of blood taken may be largely increased by the subsequent application of a hot poultice.

A convenient instrument for abstracting blood, in use in the eye wards, is Heurteloup's artificial leech. It consists of a fine circular knife projecting from a metal case, the length of blade being capable of alteration according to the thickness of the skin, and having an arrangement for rapidly rotating the blade. An incision is made by pressing the machine against the skin and rotating the knife, an exhausting syringe is then applied, and a measured amount of blood withdrawn. The little incision leaves no scar.

Application of nitric acid.—This will be necessary occasionally to arrest the progress of sloughing in important tissues. In order to render the application effectual, the part must be thoroughly dried; and since the destruction of tissues is necessarily painful, it will be well in severe cases to administer chloroform prior to the operation. The nitric acid should be the strongest fuming acid, and may be most conveniently applied on a piece of firewood, cut to a suitable point, this being preferable to the glass rod or brush. The acid should be applied freely around the margin of the slough, and should involve a line of healthy tissue beyond the disease ; for unless this is done the sloughing action will very probably recur.

A linseed poultice sprinkled with iodoform, or the charcoal poultice, when the surface is extensive, forms the best after-treatment.

Subcutaneous injection.—This method of administering stimulants or sedatives is often of the greatest utility. It consists in injecting from three to six drops of a sedative solution into the subcutaneous tissues by means of a small syringe fitted with a hollow needle. The syringe made with an ordinary piston is preferable to that fitted with a screw, and care must be taken that the needle is both pervious and sharp. A piece of silver wire should be kept in the needles when not in use. The syringe shown in fig. 66 has the needle made of a composition which allows of its being heated in the flame of a spirit-lamp so as to insure perfect asepticism, and the piston fits closely to the base of the needle. The solution should be concentrated, so that the required dose may be contained in not more than five or six drops ; and the addition of a few drops of glycerine to the solution obviates the troublesome efflorescence around the stopper of the bottle. The solution for hypodermic injection of the British Pharmacopœia contains

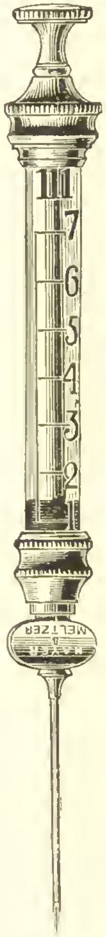

FIG. 66.

one grain in ten minims, and the addition of gr. $\frac{1}{60}$ of sulphate of atropine to each dose has a great effect in preventing the occurrence of sickness, which sometimes follows a hypodermic injection. The best method is to draw up a quantity of the fluid into the syringe, and then to bring the piston slowly down to the mark indicating the proper dose. The syringe being then inverted, a little air should be drawn in, which secures that the whole of the injection leaves the syringe and is rapidly absorbed. The skin of the arm (or painful spot if preferred) being pinched up with the finger and thumb (fig. 67), the point of the needle is to be thrust boldly into the subcutaneous tissue parallel to, and not across, the fold, which should be released again before the fluid is injected. The aperture made is so fine that the fluid cannot escape, and ordinarily it gives no further trouble. The syringe and the needle should be washed out with cold water, and have some air forced through them to dry them before they are taken apart and the wire is replaced in the needle.

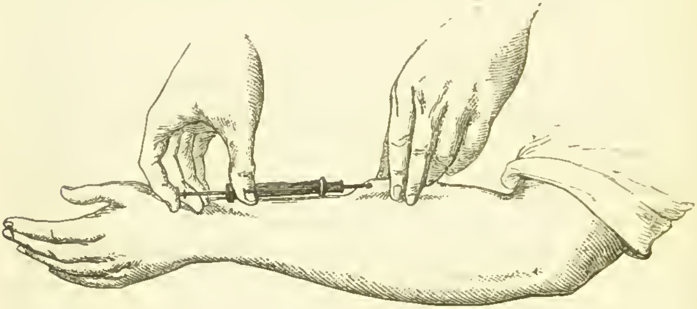

Fig. 67.

Vaccination.—This operation may be performed either by making punctures, or by abrading the skin with scratches. An ordinary lancet is the simplest instrument for the purpose, but a lancet with a small hollow in it, or Spratley's vaccinator, may be employed for the punctures, and the little pronged scratching instrument for scoring the skin, if preferred. The position usually chosen for vaccination is as near the insertion of the deltoid as may be, on the left, or both, arms. The punctures (three or four in number) are best made from above, so that the lymph may gravitate into them, and should not draw more than a trace of blood ; they should not be made so close together as to cause the resulting vesicles to become confluent.

The vaccine lymph is best taken from the fully formed vesicle of a healthy child at the time, but may be preserved on ivory points, between glasses, or better, in glass tubes. If points are used, they should be moistened with the breath before being inserted into the punctures, in which they may be left some minutes. If glasses are used, the lymph must be moistened before it is taken up with the lancet ; and if tubes are employed, the extremities are to be broken off and the lymph is to be gently blown on to the lancet.

As capillary tubes are now very generally and successfully employed for the preservation of vaccine lymph, the following directions for using them are extracted from Dr. Husband's report to the Privy Council (1860) :—

The vesicles having been opened with a lancet in the usual way, the tube, held in a position more or less inclined to the horizontal, is charged by applying one end of it (the straight end, if they be not both straight) to the exuding lymph, which enters immediately by the force of capillary attraction. Allow as much to enter as will occupy from about one-seventh to one-half the length of the tube, according as its capacity is greater or less. As a general rule each tube should not be charged with more than will suffice for one vaccination.

Next make the lymph gravitate towards the middle by holding the tube vertically and giving it a few slight shocks by striking the wrist on the arm or table ; then seal the end by which the lymph entered by applying it to the surface of the flame of a candle, or any similar flame. It melts over and is sealed immediately.

Proceed with the other end in the same way, but first plunge it suddenly, say, half an inch into the flame, and as quickly withdraw it till it touches the surface, and hold it there till it melts over.

The following are the published directions for using the calf-vaccine :—

Scratch the arm in three to five places, from three-quarters of an inch to an inch apart, about the insertion of the deltoid muscle of the left arm. The number of places must depend upon the extent of each scarification. The total aggregate area of the resulting cicatrices in a first-class vaccination—*i.e.* one that is considered to confer the full amount of protection—should be at least half a square inch.

The scratches should only just draw blood ; but if the bleeding be considerable, allow the blood to dry on, then wash it cleanly off, and wipe the scratches dry.

If tubes be used, blow the lymph either upon a glass, the scratch, or the head of a pin-point, and rub the vaccine lymph *well and briskly* into the scratches with the eye of the needle or the head of the pin-point.

If points be used, touch the charged ends of each point with a little clean tepid water (under 100° F.), and leave the lymph to soften for two or three minutes ; then rub the charge into the scratches until no vaccine matter is left upon the point. If the scratches still bleed after the rubbing, gather the blood over them and let it dry there.

If pomade be used, stir it well in the vial ; then take a small quantity out, spread it over the scratch, and rub well in. A pin-point is very convenient. Any unused pomade may be preserved for future use by keeping the vial well corked and in a cool place.

CHAPTER VI

OPERATING-THEATRE—TREATMENT AFTER OPERATIONS —ANTISEPTIC SYSTEM—ANÆSTHETICS

Operating-theatre.—The position which the house-surgeon occupies in the operating-theatre varies very considerably in different hospitals. In some the colleagues of the operating-surgeon alone assist, and the house-surgeon's duty is confined to handing instruments and sponges ; in others, the house-surgeon administers chloroform ; while in a comparatively small number the operating-surgeon depends upon his house-surgeon and dressers for all ordinary assistance, and only asks the aid of one of his colleagues in cases of difficulty.

Believing the latter practice to be the best for all parties, including the patient, the author will confine these remarks to that arrangement.

A patient about to take anæsthetics should have the bowels well cleared out on the day before the operation, unless his health be so precarious as to forbid the administration of opening medicine. This applies particularly to robust patients admitted for some trifling surgical proceeding, who are apt to suffer more from chloroform-sickness than those who have been already dieted in the hospital.

The house-surgeon should see that the patient does not take any solid food for at least four hours before the hour of operation, although in the case of feeble patients the administration of stimulants may be advisable within a much shorter time ; and in the case of serious operations it is well to inject two ounces of brandy with four ounces of hot water into the rectum half an hour before the operation. The part to be operated upon is prepared in the ward, some hours before the operation, by being shaved, so that hairs may not obstruct the surgeon's incisions, and is thoroughly washed with soap and water, and then with ether and carbolic lotion ; after which it should be wrapped in towels, dipped in warm carbolic lotion, these being again covered with oil-silk and bandaged. The theatre and passages should be thoroughly warmed, and the patient carefully wrapped up while being conveyed to the theatre, lest cold should be taken at this critical moment.

All the instruments which can by any possibility be required in the operation should be placed in a shallow earthenware tray filled with a 5-per-cent. solution of carbolic acid, and be covered with a cloth ; or be sterilised by boiling for five minutes in water containing 1 per cent. of carbonate of soda, in some form of steriliser. On removal from the boiler they should be placed in trays, previously boiled in the soda solution and filled with it or a solution of carbolic acid and soda, of each 1 per cent. Cutting instruments should be boiled for only one minute, or they will be blunted. During the operation, instruments which have been used should be redipped in the carbolic or washed with cold water and again boiled. After the operation the instruments should be well rinsed in cold water, scrubbed with a hot solution of soda and soap, and finally dried and rubbed with alcohol and a chamois leather.

Bandages and dressings should be prepared, suitable for the expected operation. The Listerian dressings are described at p. 179. Those surgeons who employ sterilised dressings require dry heat for the purpose, and the apparatus shown in fig. 70 may be used for the purpose, but without water. For large dressings a larger steriliser (fig. 68) may be employed. It consists of a double cylinder, the space between which is filled, about one-third full, with water, poured through the funnel A, and shown in the water-gauge B. The material to be sterilised is

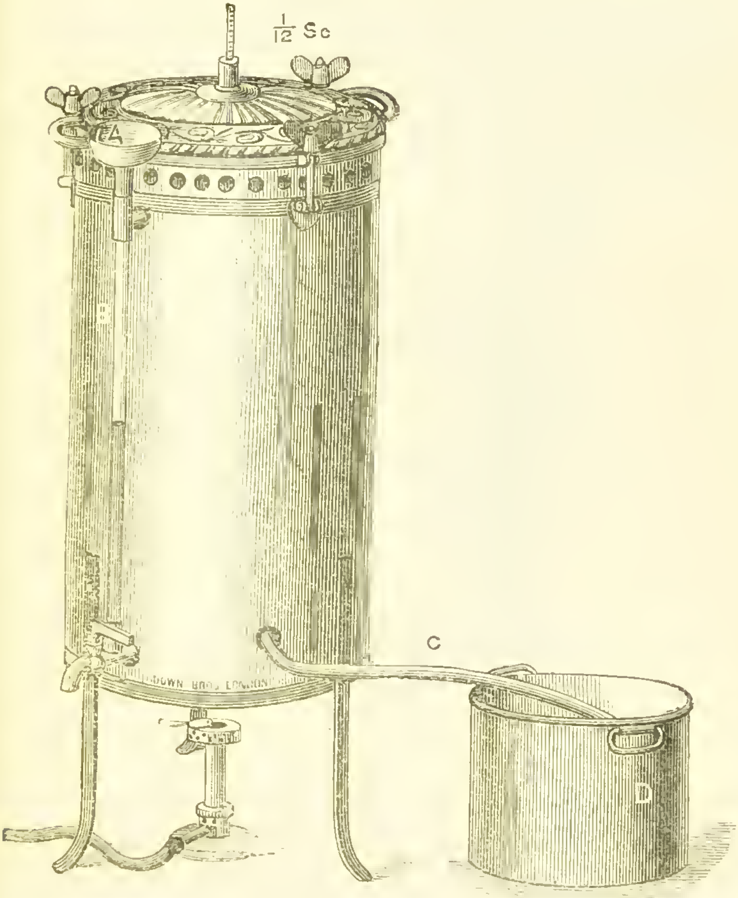

Fig. 68.

placed within the cylinder, and the top is screwed down. The gas is then lighted, and the escape tube C placed in the condenser D with enough water to cover the end. After the temperature, as indicated by the thermometer, has risen to 100° C. the heat should be maintained for three-quarters of an hour.

If the dressings are to be kept for some time they should be enclosed in a dressing box (fig. 69), which is put into the cylinder. The holes in the upper and lower parts are opened by slides to allow the steam to permeate, and on removal from the cylinder these holes are closed. The dressings may be preserved by being simply wrapped up in Gamgee tissue. In order to prevent the dressings from getting wet by the steam condensing on them, which it does if they are cold, they should be placed in the cylinder before the steam is fully generated. If they come out damp, by leaving the holes in the dressing-box open for a few minutes after it is removed from the cylinder they get quite dry.

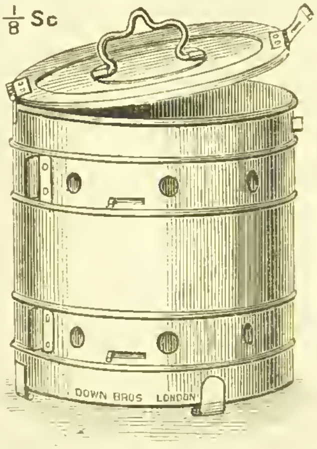

FIG. 69.

A convenient portable form of steriliser is shown in fig. 70. It consists of a flat kettle, into which fits a wire tray for the instruments. The cover of the kettle forms the cooling tray, into which the wire is lifted after the instruments are sterilised. The spirit-lamp goes inside, but in a theatre gas would be preferable.

Needles ready threaded with silk or catgut should be placed in a separate tray of 5-per-cent. carbolic solution. The silk may be boiled in the soda solution and then kept in a 5-per-cent. carbolic solution. (See also p. 45.)

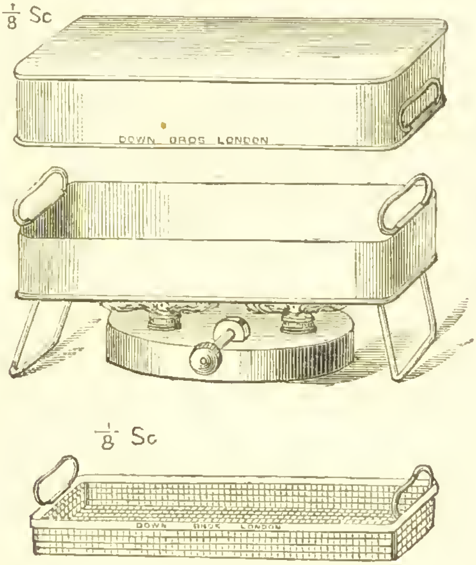

Fig. 70.

Hot and cold water are matters of course in an operating-theatre ; but some surgeons will use no water but that which has been boiled and allowed to cool. The house-surgeon should take care to have the means for heating a cautery, if Paquelin's thermo-cautère (p. 112) is not at hand, whenever that instrument may possibly be required. It is well, also, to have a little wine or brandy and some smelling-salts within reach, in case of sudden emergency, as well as an electro-magnetic machine, which takes up very little room.

The operating-table should have a folded blanket upon it, and a pillow or two. A piece of mackintosh cloth should be placed over the part of the table at which the hæmorrhage will occur, and a tray of sawdust should be placed below to prevent drippings upon the floor. Towels wrung out of hot carbolic solution (1–20) should be arranged so as to protect the neighbouring parts, and the actual seat of operation should be enveloped in similar towels after thorough cleansing. Everything should be perfectly ready before the patient is brought in, so that the inhalation of the anæsthetic may be begun at once, if it has not already been administered in an adjoining room. A dresser should stand on each side of the patient while the anæsthetic is administered, to restrain his sometimes violent contortions.

The best position for the house-surgeon is, as a rule, *opposite* the operating-surgeon. One dresser should take charge of the instruments, and should be instructed as to the order in which they will be wanted ; and others will be required to hold the patient, to sponge, &c.

The sponges should be fine and soft, and scrupulously clean, being kept in 5-per-cent. carbolic lotion in the intervals of use. After the operation they should be soaked for a day or two in a solution of borax soap-powder, and be thoroughly washed before being replaced in the carbolic lotion. Another method is to rinse the sponges out thoroughly in cold and then in warm water until all blood-clot is removed, then to put them into a linen bag which is placed in soda solution, just at the point of boiling, for half an hour. They are then washed out in boiled water and kept in a sublimate solution 1/1000. Sponges should not be boiled. At the operation the sponges should be kept moist with some antiseptic solution, but thoroughly squeezed out, so that they may be ready to absorb the blood directly they are placed upon a wound. Nothing can be more annoying to the operator than to have the wound filled with water by a careless assistant.

Artificial sponges, which can be burnt when used, may be made of gauze cut into squares eight inches each way, folded together, and rolled into a ball. Or bags of gauze may be stuffed with absorbent wool or moss. They must be sterilised with the other dressings.

Esmarch's method of obviating hæmorrhage has of late come into general use, and may be advantageously employed in most operations on the limbs. It consists in blanching the limb to be operated on by carefully bandaging it from below upwards with a strong elastic webbing. This should be carried up from the toes or fingers without any 'turns,' and should be made to cover the limb completely for some distance above the seat of operation. The elastic cord is next made to encircle the limb two or three times close above the bandage, which is then unwound, leaving the surface of the limb pale and the blood-vessels empty.

It is unnecessary to pull the encircling cord very tight, and there is a danger of damaging the large nerves of the arm if this be done; in the case of children a few turns of the elastic bandage are better in all positions. In the case of collections of pus in a limb or joint, it will be unadvisable to apply the elastic bandage very firmly, for fear of bursting the wall of the abscess and forcing the matter among the tissues; and the same caution applies to cases of morbid growth of various kinds.

Esmarch's bloodless method dispenses with the necessity for an ordinary tourniquet in cases of amputation ; but one should always be at hand for fear of any accidental failure of the elastic cord, or where a reliable assistant to compress the main artery is not available.

While the patient is being placed under the influence of the anæsthetic, the operator and his immediate assistants should carefully prepare their hands by thorough scrubbing with soap and hot water, and immersion in some antiseptic solution. The fashion of operating in shirt sleeves, aprons, or white coats varies in different theatres and with different surgeons, and may be left to individual taste. The house-surgeon will be ready to sponge, hold back flaps, &c., as directed, and finally to tie the ligatures upon the vessels as the surgeon takes them up. (See p. 41.)

It is well worth the house-surgeon's while to practise tying ligatures privately, that he may commit no blunder in public. Since every drop of blood is of importance, the house-surgeon and other assistants should be on the alert to arrest at once the stream of blood from a divided vessel by placing a Wells's forceps upon it, care being of course taken not to obstruct the progress of the operation by such measures. In the case of operations for hare-lip, cancer of the lower lip, &c., the hæmorrhage will be more readily controlled by compressing the whole thickness of the lip between the finger and thumb than by any other method. It is always to be borne in mind that the convenience of students and others in the theatre should be consulted as far as possible, and the assistants should therefore be careful not to stand in the way, and to obscure the view as little as possible with their hands and sponges.

The assistant, to whom the office of holding a limb about to be removed by amputation is delegated, must be especially careful to have a firm grasp of it by means of a towel or bandage wrapped around the part, and should then draw the limb horizontally away from the body, and never either up or down while the saw is being applied ; since, if he neglect this rule, either the saw will become locked or the bone will be splintered.

The operation being concluded, the house-surgeon should carefully sponge away all traces of blood &c. from the patient's body, and as far as possible from the clothes if they are besmeared, and should then see that the patient is carefully removed to bed.

The readiest way to remove a patient is to place on the table beneath him a canvas stretcher, into the sides of which poles can be slipped, with iron cross-bars to keep them apart. The bearers should *not* keep step in carrying a patient, for if they do he will be swung to and fro at each step. This rule applies also to the conveyance of wounded or injured persons to a hospital or on the field of battle, when, if there are four bearers, the front and rear men of *opposite* sides only should keep step. A stretcher should never be raised to the shoulders of the bearers, unless the patient is effectually secured by straps, and the bearers are all of one height. In carrying a patient who has lost much blood upstairs it is well to make the head dependent.

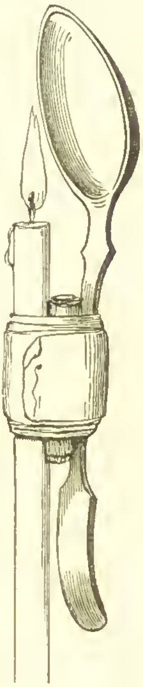

Fig. 71.

Daylight is of course best for every operation, but for night work the operating-theatre should be fitted with movable electric lights or with gas-lamps having good reflectors. Even with these a bull's-eye lantern or candles with reflectors are extremely useful for delicate operations ; and, failing them, recourse may be had to Esmarch's ingenious contrivance of a spoon attached to a candle by means of a bandage, as shown in fig. 71.

Patient's bed.—While the patient is in the operating-theatre, his bed should be prepared for his reception according to the nature of the case, and in cold weather should always be warmed with a hot bottle, which can afterwards be moved to the patient's feet. In any case of severe operation, when the patient will be confined to bed for some time, a 'draw-sheet,' *i.e.* a sheet folded so as to be about a yard wide, should be laid over the ordinary sheet, and across the bed where the pelvis will lie; one end of this being tucked in, and the other rolled up on the opposite side of the bed, a fresh portion of it can be drawn underneath the patient when required, with very little trouble. When the operation involves the urinary organs &c. it is well to put a mackintosh cloth beneath the draw-sheet; and a large sponge should be placed to soak up the urine in cases of perineal lithotomy &c.

In order to keep the patient dry after supra-pubic cystotomy, it will be found convenient to cut a suitable hole in the middle of a sheet of oil-silk or thin waterproof, and then to fix it to the abdominal wall by good adhesive plaster applied round the opening, as in the sheet commonly used in abdominal sections. Pads of absorbent moss being laid over the opening, the sheet of oil-silk is folded up over them so that no leakage may occur. The pads will of course require to be changed every few hours. An ingenious and yet simple plan for draining the bladder, contrived by Mr. Cathcart of Edinburgh, is shown in fig. 72. The bent glass tube, or a gum-elastic catheter, passed through the supra-pubic opening, is connected by a Y or T glass-tube with an indiarubber tube leading to a reservoir, through which the flow of water is regulated by a clamp, or more simply with a hair-pin. The tube below is connected with a S glass-tube, or may be carried straight into a vessel half filled with water. A syphon action is thus maintained by the constant though slow flow of water, and the bladder is kept empty.

In all affections of the genital and urinary organs, undue exposure of the patient's body to cold should be guarded against, lest the tendency to rigors should be aggravated by draught. This is easily arranged by folding two blankets and placing them across the trunk and thighs of the patient respectively, the genitals being left exposed so soon as the sheet and coverlet are withdrawn. A draw-sheet, and in some cases a mackintosh cloth, should be placed under the part on which the operation has been performed, and care should be taken to support stumps with suitable

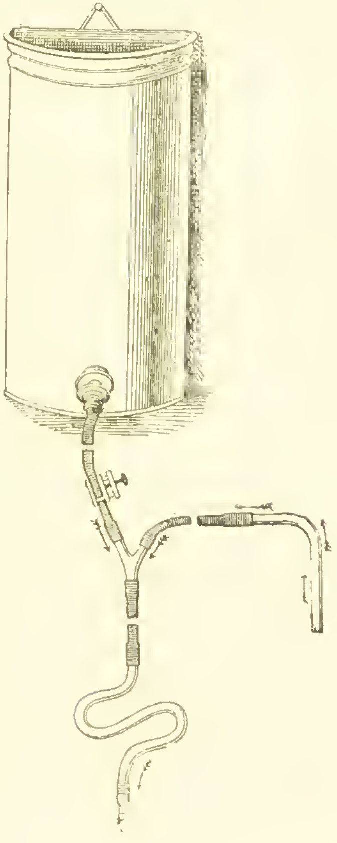

FIG. 72.

pillows, which should be covered with some waterproof material. The weight of the bed-clothes should be kept off the wounded part by a suitable 'cradle,' a very good substitute for which can, on an emergency, be improvised out of an old hat-box split open and stretched over a patient. Care must be taken, however, that the rest of the patient's body is not chilled by the action of the cradle, which can be obviated by the use of flannel or a hot bottle.

Treatment after operations.—Although the operating-surgeon may give some general directions with regard to the after-treatment of operation cases, the supervision of them will fall principally upon the house-surgeon. The patient, particularly if not quite recovered from the effects of the anæsthetic, should not be raised too much into a sitting posture when placed in bed; and this rule must be observed for many hours in cases where much blood has been lost. Sickness is unfortunately a very common sequel of anæsthetics, and may produce alarming exhaustion if not checked at an early date. Ice, brandy and soda-water, and small doses of effervescing medicine are the best remedies; and if these do not succeed, five minims of dilute hydrocyanic acid in effervescence, or a drop of creasote in a pill, will often do good, together with counter-irritation to the region of the stomach. In obstinate vomiting, drop doses of ipecacuanha wine repeated every half-hour will often prove satisfactory when other remedies have failed. Sipping water as hot as can be borne is often effectual in allaying chloroform-sickness.

Stimulants may be needed from the first in very bad cases, but it is a great mistake to worry the stomach unnecessarily with them, and so perhaps induce sickness. They should be given in small doses frequently rather than in larger quantities at longer intervals; thus one or two drachms of brandy every hour give better results than half an ounce every two hours. The pulse will be the great guide in the treatment, and should that begin to lose power, stimulants must be had recourse to without delay, and at the same time care should be taken that the heat of the body is maintained.

Opium in some form will probably be required after an operation; and here, again, better results will be obtained, especially with children, by giving one or more drops of laudanum every half-hour or hour, until the pain is lulled, than by one large dose which may induce vomiting. The subcutaneous method of administering morphia is an extremely convenient mode of giving relief, but the patient must not be allowed to get into the habit of taking that drug unless the peculiar nature of the case requires its administration. Night draughts, to be of service, should be administered not later than 8 P.M., but their general use should be discountenanced. A patient who has already taken opium, but cannot get to rest for the pain of an operation &c., may sometimes be lulled at once by a few whiffs of chloroform, and may sleep for hours; but the administration of this drug must never be entrusted to a nurse. The chloral hydrate may be advantageously substituted for opium and its preparations in many cases of simple sleeplessness.

The amount of appetite after severe operations varies very considerably with different patients, some being able to resume their ordinary diet with relish on the day after operation, while others require milk diet, beef-tea, &c., for days together. It is of course impossible to coerce the appetite of a delicate patient; but the sooner he can be induced to resume meat and other nourishing food, and dispense with 'slops,' the better.

Delirium tremens.—A patient whose nervous system has been shaken by drink is apt to be sleepless and irritable, and, after an accident or operation, may pass into the condition known as *delirium tremens.*

Sleeplessness, with a tendency to see spectres about the bed, to pick the bedclothes or throw them off, to pull off the bandages or splints, and to get out of bed, are the common symptoms, combined with a tremulousness of the hands, from which the disease gets its name. Care must be taken to restrain such a patient from doing himself injury by thoroughly fastening all bandages, and by securing him in bed with a sheet folded across him. An attendant sitting by the bed for a few hours will then be able to restrain him sufficiently; but in violent cases it may be necessary to secure the arms with a 'strait-jacket.'

The obvious treatment is to induce sleep, and this can be done more safely with hydrate of chloral than with opium. Twenty grains of chloral with twice the quantity of bromide of potassium should be given at once, and half the quantity may be repeated every four or six hours, until an effect is produced. Nourishment in a liquid form should be taken frequently, but no stimulants should be given during the attack without the sanction of the surgeon.

Antiseptic system.—Many attempts have of late years been made to modify the suppuration of wounds by the application of various chemical agents immediately after an operation. The old-fashioned friar's balsam (Tinct. Benzoini Co.) was one of the earliest used applications of the kind, and is, no doubt, of service in contused and lacerated wounds. In cases of compound fracture it may be poured into the wound, and, soaked into a piece of lint, will form a dry scab over it. A solution of chloride of zinc, from ten to forty grains to the ounce in strength, or the acidum sulphurosum (B.P.), either pure or diluted, or tinctura iodi diluted to the colour of pale sherry, is certainly very efficient, provided due exit for discharges or drainage be maintained.

This necessity for the discharge of the serum which is poured out within a few hours of an operation was much insisted upon by Professor Syme, and forms one of the most valuable parts of Lister's antiseptic system, since pent-up fluid is liable to rapid decomposition, and is apt, not only to become purulent, but to be the cause of great constitutional disturbance in the patient. Drainage may be provided by leaving a dependent opening, or by the insertion of a drainage-tube or a slip of gutta-percha tissue; and the drainage should be into some absorbent and aseptic material.

The following extract from a lecture given January 18, 1893, by Sir Joseph Lister, gives a useful *résumé* of his practice:—

'We may dispense entirely with irrigation, whether in the form of the spray, which was a kind of irrigation, or in any other; in fact, our operations may be performed with just the same simplicity as in former years. What we have to attend to is to prevent the entrance into our wounds, during operations, of the grosser forms of septic mischief, such, for instance, as exist in impure sponges, on dirty instruments, or in any unclean material upon our hands or on the skin of the patient. Then, again, the *entourage* of the seat of the operation must be considered. To speak first of this last point, we cover the region round about the field of operation with towels soaked in a trustworthy antiseptic solution, and then we are quite sure that if we touch any neighbouring object there can be no chance of our contaminating the wound as the result of this contact.

'As to the best means of purifying the sponges &c. it appears that there is, after all, nothing better than the agent which I happened to employ first—carbolic acid. There was a time when, in consequence of Koch's publications on the subject of corrosive sublimate, it to a large extent displaced carbolic acid in the practice of surgeons. It turns out, however, that Koch, able as he is, was misled on a certain point which led him greatly to exaggerate the germicidal powder of corrosive sublimate, and that in truth it is for surgical purposes very inferior to a solution of carbolic acid in water. I have long been convinced by experience that we need not fear tubercle bacilli in our sponges if we keep them for a considerable time in 1-in-20 carbolic lotion.

'The way in which our sponges are treated is this: they are washed well with soap and water, and afterwards with soda; then thoroughly washed again with water, and finally, after drying, put to steep in 1-in-20 carbolic solution till they are again required for use. For my own part, I purify my sponges for private operations in a somewhat rough-and-ready way. I put the sponges after an operation into a tank of water, and let them putrefy there. The fibrin, which clings among the pores of the sponges, becomes liquefied by putrefaction. They can then be washed thoroughly clean of their fibrin, and the washing is continued until they no longer give a red colour to water. They are then put into 1-in-20 carbolic solution and kept there. In my Edinburgh practice I used to proceed in a bolder way. Taking the sponges out of the putrid tank, I washed them in water, and sometimes, if I was in a hurry, even before the water which came from them was completely freed from red colour, I dipped them into the 1-in-20 carbolic solution, and took them at once to my operations. I have before now applied a sponge so treated immediately to a wound for the purpose of exercising elastic pressure and absorbing blood and serum from it, and then put on my external antiseptic dressing over it without any bad result. These facts taken together will, I think, be enough to convince you that it is not necessary, as is sometimes done, to discard these most valuable articles, and substitute for them sterilised cotton-wool or tissue of one kind or another, incomparably inferior to sponges for the purpose of absorbing blood.

'This same 1-in-20 carbolic solution is what we use for purifying our instruments, our hands, and the skin of the patient. For the instruments, it is very much more convenient to be able to purify them by a solution like this than to boil them, as is sometimes the fashion at present. It is all very well in a large hospital, where you have conveniences for the purpose of heating to any temperature you please the instrument or whatever it is you wish to sterilise, but for private practice it is a most inconvenient thing to have to boil your instruments; and even when you have boiled them and brought them sterilised to your operation, it often happens that an instrument falls upon the floor or comes in contact with some source of contamination. You cannot boil it again before going on with the operation, but the bath of carbolic lotion at once puts it right.

'As to the length of time for which the instruments should be kept in the solution, a good deal depends upon the care with which you wash your instruments before putting them away. Any which have teeth, such as forceps, require special attention. They should always be brushed with a nail-brush before they are dried, so that there may be no crusts of dried blood upon them, which the carbolic lotion might require a considerable time to penetrate. If this has been done, a very short period is sufficient for sterilising. In private practice I put the instruments into 1-in-20 carbolic lotion just before the patient is brought into the room. They continue to be kept in it during the administration of the anæsthetic and during our other preparations, and this is quite adequate for the purpose. It is of great importance that we should not make things unnecessarily complicated.

'So also with the purifying of the skin of the patient. It is not needful to apply an antiseptic lotion for hours together, as is sometimes done; a few minutes' action of the 1-in-20 carbolic solution is really sufficient. For purifying the eyelids before ophthalmic operations the carbolic lotion would cause serious irritation. In this special case a weak solution of corrosive sublimate, applied in compresses, is probably the best. It must, however, be continued for a lengthened period.

'While carbolic acid is more trustworthy as a germicide for surgical purposes than corrosive sublimate, it is in other respects also greatly to be preferred. Carbolic acid has a powerful affinity for the epidermis, penetrating deeply into its substance; and it mingles with fatty materials in any proportion. Corrosive sublimate solution, on the other hand, cannot penetrate in the slightest degree into anything greasy, and therefore, as the skin is greasy, those who use corrosive sublimate require elaborate precautions in the way of cleansing the skin—treating it with oil of turpentine or ether, not to mention soap and water, to remove the grease which they feel it essential to get rid of for the efficient action of the corrosive sublimate. Now all this is unnecessary care if you use carbolic lotion. I can testify to this from very ample experience. For my part I do not even use soap and water. I trust to the carbolic acid, which, by its penetrating power and great affinity for organic substances, purifies the integument in a way that inorganic salts, like corrosive sublimate, cannot.

'Our sponges during the operation are washed with 1-in-40 carbolic lotion. You will see how important it must be to have your nurses and assistants careful. In truth, it needs no small pains to teach them to take the care, simple as it is, yet all-important, that is requisite for avoiding the contamination of a wound with gross septic material. Finally, because we cannot be always quite certain of our assistants being as careful as we wish, before we close the wound we wash it with 1-in-40 carbolic lotion. This irritates very much less than the spray, which applied a stronger solution during the whole operation; and in proportion to the diminished irritation there is less serous effusion, and therefore less necessity for drainage.

'*Antiseptic dressings.*—An external antiseptic dressing, to be ideally perfect, should have four essential qualities. It should contain some thoroughly trustworthy antiseptic ingredient; it should have that substance so stored up that it cannot be dissipated to a dangerous degree before the dressing is changed; it should be entirely unirritating; and it should be capable of freely absorbing any blood and serum that may ooze from the wound.

'The carbolic gauze which we formerly used did, indeed, contain a very efficient antiseptic; but this, being volatile, was perpetually flying off in spite of our endeavours to fix it, and it was a matter of uncertainty in how many days it might have so far disappeared from the dressing as to leave it untrustworthy. Carbolic acid had also this disadvantage as an element of an external dressing—that, acting, as we have seen, with peculiar energy on the epidermis, it interfered seriously with cicatrisation, and we were obliged to interpose what we termed a "protective" to shield the healing wound from its action. And this gauze, containing resin for the purpose of fixing the carbolic acid, was not a very good absorber of blood and serum. Carbolic gauze, then, was not an ideally perfect dressing.

'Corrosive sublimate had the advantage over carbolic acid of not being volatile. But it was readily washed out of gauze or wool charged with it, and under some circumstances it proved very irritating. The discharge, passing from one part of the dressing to another, took up more and more of the bichloride in its passage, and sometimes became so strong a solution of the salt as to cause vesication. I endeavoured to remedy these defects by combining the bichloride with the albumen of the serum of horse's blood. But though the sero-sublimate gauze answered its purpose, in so far that it contained the bichloride better stored up and in a less irritating form, it had inconveniences, especially as regards its preparation, which induced me to abandon it.

'The agent which we have found the most satisfactory as the antiseptic ingredient of the dressing is the double cyanide of mercury and zinc. Cyanide of mercury, while it has powerful antiseptic properties, is very soluble and highly irritating; but the combination of cyanide of zinc with it has the same sort of effect, but in a much higher degree, as the albumen of the sero-sublimate gauze had upon the bichloride. The combination with zinc keeps the cyanide of mercury from being dissolved away, and also prevents it from irritating. It is, so to speak, chained down by the cyanide of zinc with which it is combined. The double salt is very little soluble in blood serum, requiring between two and three thousand parts to dissolve it; and thus a small quantity of it will last a long time in spite of a free flow of discharge through it. It thus fulfils the condition of the persistent storage. It is at the same time practically unirritating; wounds heal under its immediate contact without the necessity for a protective layer interposed. Then, as to the essential question of its antiseptic virtues. Small as is the quantity which serum dissolves, it proves amply sufficient to prevent bacteric development.

'But here I must remind you of the essential difference, which must always be kept in view in considering antiseptic agents, between germicidal and inhibitory power—that is to say, between the capability of destroying the life of microbes, and that of preventing their growth while the agent remains in contact with them. These two properties are by no means similarly proportioned to each other in all antiseptics. Thus, cyanide of mercury is far superior to the bichloride in inhibitory power, but very inferior to it as a germicide. And the double cyanide of mercury and zinc, while admirable as an inhibitor, is very feeble as a germicide; so that we can have no security that materials charged with it may not contain living organisms. Hence, if gauze charged with the double cyanide were applied dry to a wound, the time might come when, if the discharge were free, the salt, in spite of its slight solubility, might be all washed out of the deepest parts of the dressing; and as soon as this should be the case, living microbes contained in it would be free to develop towards the wound. In order to guard against this risk, we treat the gauze before using it with a reliable germicide. That which we now use for the purpose is the 1-in-20 solution of carbolic acid, which, besides being thoroughly effective, has the further advantage that it soon flies off from the dressing, and leaves nothing in contact with the wound but the unirritating double cyanide and cotton fabric.

'It is quite unnecessary to have the gauze wet with the 1-in-20 carbolic lotion; mere dampness is sufficient. It may be conveniently moistened as follows:—The gauze is commonly sold in pieces of three or six yards, folded lengthwise in eight layers. These are unrolled, and half the number to be moistened are sprinkled roughly with the lotion. The wet and dry pieces are then superposed alternately, and the whole rolled firmly together; and in a few minutes the entire mass will be uniformly damp. This may be done by a nurse, who then folds the gauze up in a piece of mackintosh cloth to prevent evaporation; and if the precaution is taken of turning over the edge of the jaconet so as to prevent the cotton from coming in contact with the gauze, and abstracting moisture by capillary attraction, it will remain damp for weeks together. Used in this way the double cyanide gauze may be absolutely trusted for excluding mischievous microbes; and we have seen that it contains the antiseptic element excellently stored up, and that it does not irritate; and when I add that it is all that can be desired in absorbing power, you will see that it approaches very closely to our ideal. And having now employed it constantly for over four years, both in hospital and in private practice, with thoroughly satisfactory results, I feel entire confidence in recommending it.'

Drainage-tubes of perforated india-rubber of various calibres should be thoroughly soaked in carbolic lotion for at least forty-eight hours before being used, and should have a thread or a safety-pin attached to one end to prevent disappearance within the edges of a wound. For the purpose of introducing a drainage-tube into a sinus, a slender pair of dressing-forceps may be conveniently employed.

In the case of compound fractures, a strong watery solution of carbolic acid (one part of the crystals to twenty of water), or, in the case of recent injuries, a solution of half that strength, is to be gently injected into the wound, and thoroughly squeezed into its recesses. This may be repeated more than once in the case of complicated wounds (*e.g.* fractures into joints).

With all imaginable care, antiseptic dressings occasionally 'break down,' and this may be diagnosed by a marked rise in the patient's temperature and by an offensive odour in the dressings. It is possible sometimes, by carefully syringing out the wound with a solution of carbolic acid (1 in 20), to restore a sweet and aseptic condition; but if at the next dressing matters are not improved, it is better to give up the gauze dressing, and have recourse to syringing with a lotion of chloride of zinc (gr. 5 ad f ℥j) and the use of salicylic silk or cotton-wool, or oakum.

Even with a perfectly aseptic condition of wound, a patient's temperature may run up to 103° F. from absorption of carbolic acid, to which some systems appear specially liable. Uncontrollable vomiting and fits accompanied by loss of consciousness have also been known to be due to absorption of carbolic acid. Evidence of this carbolic acid poisoning is to be looked for in the urine, which will be found to be dark-coloured, or even of a greenish-black tint after exposure to the light. Under these circumstances the carbolic dressings must either be given up or changed as seldom as possible, in order to avoid the contact of much of the irritating carbolic lotion. A rise of temperature, an erythematous rash, and hallucinations or delusions may be due to the use of an excess of iodoform. Some patients are particularly susceptible in this way.

Iodoform dressing.—The complicated system of carbolic dressing may be, in many cases, advantageously replaced by the use of iodoform. All precautions as to cleansing the part operated on, the instruments, and the hands of the operator and assistants, must be adopted as in strict Listerian dressing. The wound may be sprinkled with powdered iodoform from a pepper-caster, after being thoroughly washed out with carbolic or chloride of zinc lotion. Plenty of sutures having been inserted so as to bring the skin well together without tension, a drainage-tube should be inserted, and the wound squeezed as dry as may be. Powdered iodoform is then sprinkled over the edges of the wound, or iodoform wool applied along it, after which a thick layer of salicylic wool is applied and carefully bandaged over the wound and for some distance beyond it.

Iodoform emulsion, prepared in the following way—

Iodoform	10 parts
Glycerine	70 ,,
Water	120 ,,

is very useful, either injected into an abscess cavity at the time of operation, or afterwards if the wound has suppurated.

First dressing after operation.—The date of the first dressing will depend very much upon the nature of the case and the care taken to render the wound aseptic at the time of the operation. The less frequently a wound is dressed the better, provided the temperature continues normal, but the soaking of the dressings with discoloured serum may render it necessary to renew them on the second or third day.

The practice with regard to first dressings varies in different hospitals, but most surgeons prefer to superintend the operation themselves. In any case, everything that can be wanted should be at hand, so that the wound may not be uncovered longer than is absolutely necessary. Then, the patient lying in a comfortable attitude, and supposing the case to be one of amputation, the dresser should gently slip his disinfected fingers beneath the limb, and raise the stump from the pillow on which it is placed. This is often a most painful moment for the patient, and great gentleness must be practised, and care taken to avoid shaking the stump, which must, however, be grasped tolerably firmly to prevent its being 'jerked' by the involuntary spasm of the muscles. As soon as the stump is raised, the pillow and draw-sheet should be removed in order that they may be cleansed and renewed, and the house-surgeon is then carefully to remove the dressings. If a bandage has been applied, it must be cut with the scissors and removed in pieces; and the dressings beneath, which, unless kept wet antiseptically, will have probably become dry and hard with blood, must then be soaked with warm carbolised water, which should be allowed to trickle over them from a sponge into a bowl beneath. With a pair of forceps the dressings are next to be withdrawn bit by bit, and while removing those in immediate contact with the edges of the wound care must be taken not to drag it open, which accident is best avoided by making traction towards instead of away from the margins of the incisions.

In the case of healing stumps some surgeons prefer to apply carbolised water dressing in strips, so as to support the stump, and then to put oil-silk and a bandage over it. In order to accomplish this, the strips of wet lint should be two inches wide, and long enough to reach six inches up on both aspects of the limb. With one hand the house-surgeon places a strip beneath the limb and holds it there, while with the other the end is brought up over the face of the stump and is laid upon the front of the limb. The moisture will give the lint sufficient hold to keep its place while another strip is applied in the same manner to one side of it, but slightly overlapping, and the third upon the other side in the same way. When the stump is sufficiently covered, a long strip of lint carried circularly over the ends of the other pieces will keep them in position, as shown in fig. 73.

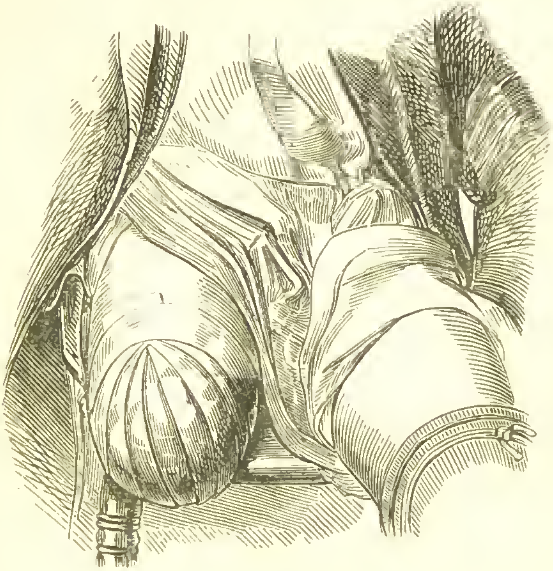

Fig. 73.

In subsequent dressings the proceeding may be a little varied: thus, strips of adhesive plaster may require to be applied or renewed, and the same precautions must be taken in removing them as in the case of the dressings. Gentle pressure may be required to prevent fluid from 'pocketing' in the flaps, and the button sutures and wire 'stitches of relaxation' may be removed as soon as they cease to be required to hold the edges together, or earlier if they begin to ulcerate through the skin, their place being supplied by strips of plaster and judicious bandaging. The 'stitches of coaptation,' consisting of carbolised silk, horsehair, or catgut, should be left until the wound is completely healed.

When the wound becomes quite superficial, boracic dressings may be used. The wound is washed with boracic lotion, a piece of protective dipped in the lotion is applied, and outside this one or more layers of boracic lint, overlapping the protective well in all directions. This dressing is changed every two or three days.

Slinging stumps.—The method of slinging, so useful in the treatment of fractures, has been adopted with very good effect in St. Bartholomew's Hospital in the case of stumps after amputation. The plan is shown in fig. 74, and consists in supporting the stump in a small linen hammock, slung from a cradle with india-rubber cord or tubing. The linen has a broad

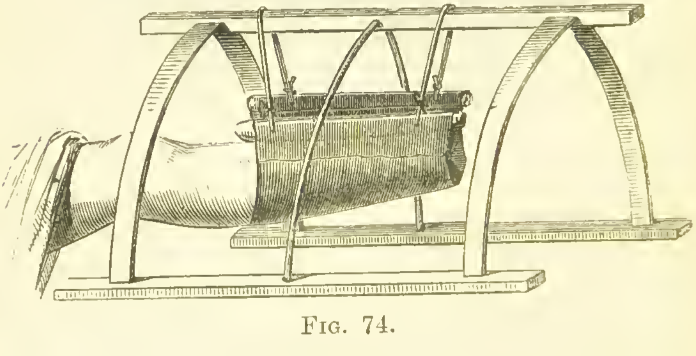

Fig. 74.

hem at each border, in which is placed a strip of wood, perforated with a hole near each end, and the india-rubber cord is passed from one hole to the other, across the top of the cradle, and through the holes on the opposite side; and, lastly, is brought over the cradle to the starting-point, where it is firmly tied. Or two separate pieces of india-rubber cord may be used, as in the illustration. The advantages claimed for this proceeding are that it entirely obviates the distressing startings to which stumps are liable, and that it allows the patient to move more freely than if the stump is laid on a pillow. Another method of suspending a limb is shown in fig. 75, being that adopted by Esmarch for the treatment of excision of the wrist, but applicable to any disease or injury of the upper limb, provided it is firmly attached to a splint.

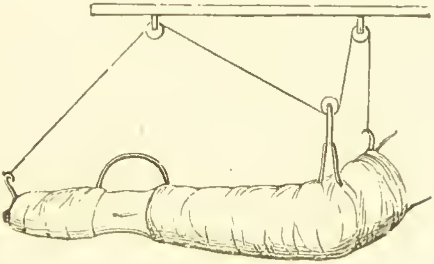

Fig. 75.

Bed-sores.—Of all the annoying complications of surgical cases, bed-sores are the worst. The greatest care must be taken to *prevent* their formation, since if the skin is once broken it is a matter of the greatest difficulty to induce it to heal again, so long as the patient occupies the recumbent position.

The slightest tenderness over the sacrum or hips should receive, therefore, immediate attention, and various applications have been suggested for the relief of the complaint. Equal parts of olive oil and brandy, gently rubbed with the palm of the hand over the tender spot for five minutes twice a day, will be found efficacious in rendering the skin tough and less sensitive to pressure. The flexile collodion painted over the part is a useful application; and some surgeons prefer to cover the tender spot with *Papier Fayard*, or felt-plaster, so as to form a cushion over it. A water-pillow under the pelvis of the patient forms a most valuable addition to either of the above modes of treatment, and an old or emaciated patient, whom it will be necessary to keep in the recumbent position for any length of time, should be furnished with a water-pillow from the first, so that all risk may be avoided.

When the skin has unfortunately given way, the best application will be found to be a linseed-meal poultice, spread to the thickness of at least an inch, so that it may form a sort of cushion as well as a moist application, and sprinkled with iodoform. The application of lint dipped in carbolic oil and covered with cotton-wool is also highly spoken of. As soon as the sloughs have come away, stimulating dressings (*e.g.* the *Ung. resinæ*) may be applied under the poultice, which should be left for the sake of its softness and warmth; and when a healthy granulating surface has been produced, which will seldom be the case until the patient's health is so far amended that he is able to sit up, the *lotio rubra*, or some other similar stimulant, will be the best treatment.

Paralytic cases require not merely a water-pillow but a water-bed, since they are liable to bed-sores on all parts of the body; and even with this and other precautions it is impossible in all cases to prevent sores forming.

In filling an india-rubber water-mattress some care is required, or it may be seriously damaged. It should never be lifted when full of water, but, being placed empty on the bedstead, *warm* water is to be poured in from cans until the mattress is about half full, when some air is to be blown in, so as nearly to fill it. A blanket and sheet being then placed on the mattress, the patient's body will be found to float comfortably upon the bed, whereas if filled too full the patient does not float; or if insufficiently filled, his weight displaces the water, and he comes in contact with the bedstead.

The Administration of Anæsthetics.—A house-surgeon should be prepared to administer an anæsthetic, and therefore should be conversant with the best methods employed, and alive to the great responsibility incurred.

Choice of anæsthetic.—Generally it may be taken as a fact, that when a patient is a suitable subject for an operation he can take an anæsthetic without especial danger. Of anæsthetics, nitrous oxide gas is the safest, ether comes next, then the A. C. E. mixture, while chloroform is the least secure.

Nitrous oxide gives a period of unconsciousness lasting only from half to one and a half minutes, and so is suitable for operations on the teeth, breaking down adhesions about joints, opening abscesses, &c. It may be given to persons of any age, and is only contra-indicated in cases of extreme cardiac feebleness or advanced lung disease. It should, when feasible, be given as a preliminary to etherisation. No special preparation of the patient is needed, beyond that it is unadvisable to administer it immediately after the patient has taken a full meal, lest vomiting ensue. As a rule no unpleasant after-effects follow nitrous oxide administration.

Ether should be administered in all cases except for (1) prolonged operations about the mouth, nose, and jaws; (2) when much cough, bronchitis, emphysema, or obstructive pulmonary disease exists; (3) for very young children; (4) in advanced arterial disease.

The A. C. E. mixture, composed of one part alcohol (sp. gr. ·795), two parts chloroform (sp. gr. 1·498), three parts pure ether (sp. gr. ·720), may be given when ether is contra-indicated by the lung condition, and chloroform appears undesirable from concurrent heart-feebleness or constitutional debility. It is a good anæsthetic for children, persons of advanced age, and in midwifery.

Chloroform is useful for jaw and tongue operations, and is well borne by children and parturients, although these persons enjoy no immunity from its dangers.

Preparation of a patient for an anæsthetic.—No solid food should be taken for six hours previously, but a basin of good beef-tea or bread sopped in milk should be given three or four hours before the anæsthetic. Weakly, enfeebled persons may take a diffusible stimulant half an hour before the operation. Prolonged fasting is injurious. Except when nitrous oxide gas is given, the horizontal posture is most desirable during anæsthetisation. The clothing should be loosened, especially about the neck, waist, and chest, and the mouth cleared of all artificial teeth, and if a small gag is used, it must be securely attached outside the mouth.

Nitrous oxide.—The apparatus required is a steel bottle capable of holding fifteen ounces by weight (=50 gallons) of liquefied nitrous oxide; a tube conducting the gas to a Cattlin's bag; a short length of tube through which the gas passes from the bag to a face-piece, which last should be provided with an expiration valve, and should fit very accurately, covering the mouth and nose. When it is proposed to give ether in succession to the gas, the arrangement above described is slightly altered; the india-rubber tube from the gas-bottle conveys gas to a Clover's gas and ether apparatus, which consists essentially of a Cattlin's bag perforated by an inch tube, which last communicates at one end with a metallic ether receptacle, and at the other with the face-piece. The supply of gas or ether is determined by moving the indicator across the dial fixed upon the face-piece end of the apparatus.

When in use, the screw-valve of the bottle is opened by the foot turning a spiked foot-piece or by a hand-key, the gas-bag is filled, and the valve admitting gas to the face-piece opened during an inspiration; then the bag is replenished during each inspiration. The face-piece is never removed from the face until the stertorous breathing and jactitation of the limbs show the patient to be fully anæsthetised. No air should be admixed with the gas, and none permitted to leak in beneath the cushion of the face-piece unless the method of giving 'gas and air' be adopted. In this case air is admitted in single breaths by raising the face-piece, but not until the patient is almost anæsthetised.

If, however, ether is to be given in succession, it is unnecessary to push the gas to stertor; the stop-cock admitting the ether is turned as soon as voluntary movements cease, and ether maintained until the operation is completed, but the face-piece must be removed every now and again. (See below under *Ether*.) It is unadvisable to repeat the administration of gas to the same person in the same day: it may produce nausea, malaise, and headache.

Ether when given by itself is best administered from a Clover's small portable regulating inhaler (fig. 76). Two ounces of ether are poured into the apparatus at A, and the indicator B which plays around the top of the dome is turned to 0. The patient is then directed to breathe deeply; in a few seconds the air-bag is inflated by catching the inspiration of the patient, and placed in position. The dome is then slightly rotated, the indicator travelling to 1, again slowly to 2, then to 3, and at last to F, about twenty or thirty seconds elapsing between the quarter-turns. If there is coughing or dyspnœal distress the rotation must be more gradual. As a rule anæsthesia by this method is complete in one and a half or two minutes.

After complete muscular relaxation and loss of conjunctival reflex the patient is ready for operation. From this point the indicator should be brought back to 2 and there kept. At every sixth respiration the face-piece D is lifted off the face *for one respiration.* In the first stage the impact of too strong a vapour may cause dyspnœa and some laryngeal spasm, which is at once relieved by giving air. Unless from time to time air is given, cyanosis, and finally cessation of respiration, will occur. Heart-failure under ether, unless from hæmorrhage or shock, is most rare. If true spasm of the glottis occur and persist, laryngotomy is called for.

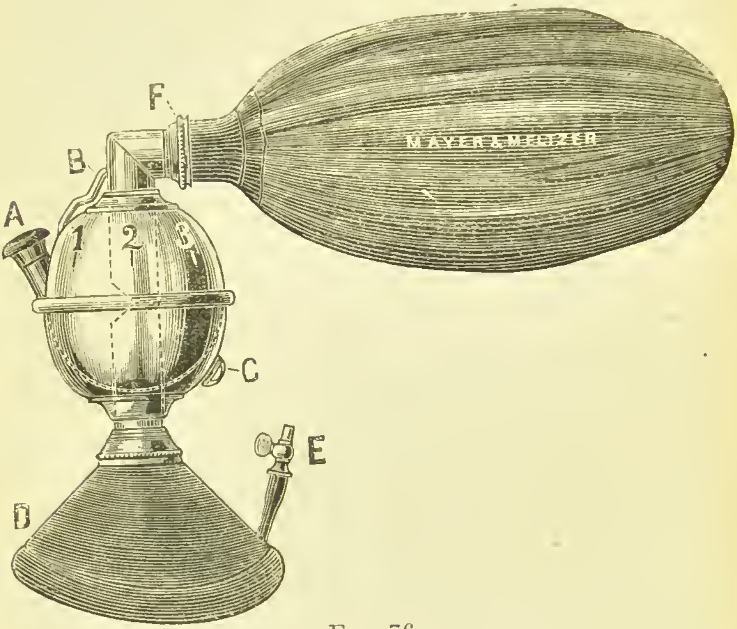

FIG. 76.

The after-effects which may arise are salivation, nausea, vomiting, headache, or bronchial catarrh, for which last full doses of tincture of belladonna are recommended by Dr. Ringer.

The *A. C. E. mixture* may be administered from a cone, from a folded towel, or even from lint. Whatever method is adopted, it is requisite to see that a very free admixture of air is permitted—far more so than in the case of ether ; and as the effects of the mixture are more lasting than those of ether, less is required to maintain anæsthesia, when once unconsciousness has been established.

Chloroform may be given by the open method. The dorsal decubitus should be insisted upon, all tight clothing be removed, and artificial teeth taken out of the mouth. The lint, eighteen inches square, folded four times, should be wetted with a drachm or so of chloroform, and held three or four inches from the patient's face. It is well to put a little vaseline over the lips and nose, and to direct the patient to keep his eyes closed, to avoid discomfort from accidental dropping of the chloroform upon the face. A towel may be laid lightly over the lint, but a free passage of air must be insured, or a too strong percentage of vapour may be given. The lint should from time to time have more chloroform dropped upon it ; but care is necessary that after each fresh dose of anæsthetic the lint is not held too near the patient's face and nose, because the respirations after the momentary admission of free air are liable to be more profound, and so too much vapour may be taken into the larynx. Chloroform may be similarly given from the corner of a towel, from a 'Hyderabad' calico cone, or by dropping it *guttatim* upon a Skinner's wire frame covered with flannel.

During chloroformisation careful watch must be kept upon the respiration, pulse, and colour of the face. Chloroform kills by inducing syncope, laryngeal spasm stopping respiration, or from failure of respiration as the result of paralysis of the medullary centres. In the early stage, syncope may arise after only one or two inspirations have been taken. It may ensue upon the use of an excessively strong vapour of chloroform, or from fright. To obviate as far as possible this danger, the patient should be reassured, loud talking of bystanders be forbidden, and the vapour of chloroform at first kept very dilute. While undue struggling should be resisted, any great display of forcible control or strapping down of arms and legs should be carefully avoided. In the struggling during the first stage, when hallucinations exist, it is right to push the anæsthetic with care until relaxation occurs, thus avoiding undue strain upon the heart. When the muscles are relaxed the breathing is regular and the heart's action even; and when conjunctival reflex—tested by touching *very* lightly the eyelid or lashes—is lost, the patient is ready for operation. After this point is reached but little chloroform is needed to maintain unconsciousness. If the operation be upon the tongue, jaws, or anywhere inside the mouth, the nasal or mouth tube is now passed and the chloroform vapour driven through it. (See below.)

Syncope, although rare, does occur in the second stage, and would seem then to be due to overtaxing of the heart by the struggles of the patient. In the third stage there is danger lest too much chloroform be given, the patient passing rapidly into the fourth stage when the medullary centres are gradually paralysed, and into the fifth when respiration ceases and the heart stops. In protracted operations, and when much blood is lost, syncope may occur in any stage of narcosis. Sudden obstruction to respiration—*i.e.* falling back of the tongue, blood entering the windpipe, &c.—is shown by quickly deepening cyanosis. Respiratory movements continue although no air enters the lungs. Dragging forward the tongue, removal of any mechanical obstruction, and complete forcible extension of the head upon the spinal column should then be tried; and, failing these, laryngotomy will be necessary, and the blood &c. must be sucked or aspirated from the trachea.

Sudden syncope should be treated by complete inversion, inhalation of nitrite of amyl, and, if breathing has stopped, by artificial respiration. Slapping the face and bared chest with towels wrung out of ice-cold water, and the use of induction shocks through the cardiac region, one electrode lying upon the spine and the other over the precordium, may be practised.

In gradual heart-failure, lowering the head, injections of ether beneath the skin, rectal injections of brandy in *hot* beef-tea, irritation of the nostrils and inferior meatus of the nose with bibulous paper soaked in sal volatile or Liq. Ammoniæ dilut., are useful. Elevation of the arms and legs, the hot bottle, or better, a stream of hot water through properly constructed tubes encircling the limbs, are serviceable adjuncts.

Failure of respiration, whenever occurring, of course must be met by prompt resort to artificial respiration.

Vomiting during an operation, especially if solid food has been taken within a few hours of the chloroforming, is dangerous: (i) it depresses the heart; (ii) there is a risk of the vomit being drawn into the trachea during the forced inspiration which follows the act of vomiting.

Severe after-sickness is best checked by giving hot water in teaspoonfuls from a glass or porcelain vessel.

Junker's inhaler as modified by Dudley Buxton consists of a graduated glass bottle into which chloroform is poured through the funnel-shaped opening, as high as the mark 8. If more be poured in, there is fear lest some liquid chloroform be injected into the patient's throat. The bottle hangs by a hook to the administrator's buttonhole. Two tubes enter this bottle; one reaches almost to the bottom, and through this air is pumped by the hand-ball (fig. 77) or by the foot working a bellows, and so causes air to bubble through the chloroform. The air thus saturated with vapour passes along the other tube to the face-piece, which is made of glass. The administrator should be careful to see that the tubes are properly adjusted to their respective ends; otherwise the chloroform will be injected into the patient's mouth. If the chloroform is exhausted, more can easily be poured in by removing the stopper which closes the funnel in the metal top of the bottle.

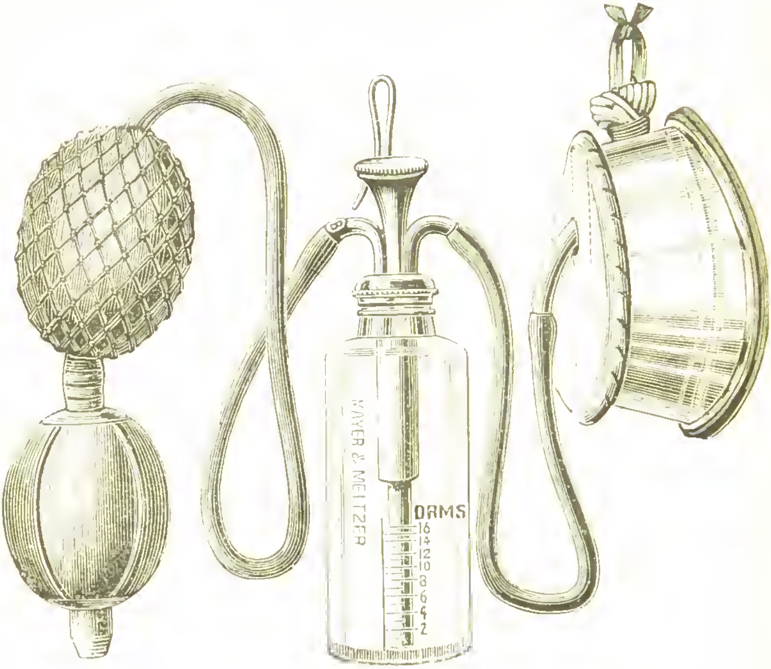

Fig. 77.

Persons who are unduly fat, or those in whom a dilated or feeble heart is known to exist, are most unsuitable for chloroform.

Ether, being highly inflammable, must not be allowed near an unguarded flame, lest it explode.

At some hospitals a proprietary article called 'methylene' is employed. It is not the chemical body bichloride of methylene, since that is non-anæsthetic and a convulsant, but is a mechanical mixture of chloroform and alcohol. When given, it is to be regarded with similar precautions as advised for chloroform administration, since it possesses the same dangers. Junker's apparatus, or the folded towel, may be employed in giving methylene.

Under most anæsthetics females are liable to suffer from hallucinations, often of an erotic nature. The administrator should therefore take care to have a third person within earshot.

Under no circumstances should the administrator allow his attention to wander from his patient's pulse and respiration.

The apparatus should always be taken to pieces before being used for a patient, and should be carefully cleansed after use. Chloroform decomposes if left exposed to diffused daylight, and noxious vapours thus become generated, which are deleterious if inhaled.

CHAPTER VII

DRESSINGS—POULTICES—STRAPPING

Dry dressings are considered by most surgeons to have a tendency to induce immediate union of freshly cut surfaces ; and partly for this reason, but still more for convenience' sake, the first dressings of a wound are frequently dry. No special direction is necessary for the application of this dressing, which should consist of absorbent or iodoform wool ; but in removing the dressing it is necessary to soak it carefully with tepid carbolic water, in order not to tear open the fresh adhesions to which it will probably be more or less attached.

Aseptic dressings and the method of producing them by sterilisation with dry heat are described at p. 162.

Water dressing is of almost universal application. It consists of a double fold of lint, of a suitable size, soaked in water or any lotion, over which is to be placed a piece of oil-silk or thin gutta-percha, to prevent the evaporation of the moisture. The waterproof covering should be *slightly* larger than the lint, and may be kept in its place by a strap of plaster or a bandage. This dressing occasionally produces a troublesome crop of pimples in the vicinity of the sore, and when this happens recourse may be had to the dry dressing or the evaporating dressing (*q.v.*) for a time.

Water dressing may be varied in form to suit the exigencies of particular cases. Thus, many ulcers will heal best when the lint is cut so as to fit exactly to the shape and size of the sore; and the oil-silk must, of course, correspond. In some wounds, and particularly in stumps after amputation, the water dressing should be applied in the form of long strips, which should encircle and support the flaps, the waterproof being applied over all (p. 185).

Antiseptic dressings.—Without attempting to carry out all those *minutiæ* which the full acceptance of the Listerian system necessitates (p. 175), most surgeons endeavour to keep their wounds aseptic; and for this purpose various plans are pursued.

1. The solution of chloride of zinc (gr. 40 ad f℥j), introduced by the late Mr. Campbell de Morgan, is a most valuable antiseptic, and may be freely applied at the end of an operation when a doubt exists as to its aseptic condition.

2. An iodine solution, made by diluting the tincture to the colour of pale sherry, is strongly recommended by Mr. Bryant.

3. A solution of boro-glyceride has been employed by Mr. Barwell.

4. The application of iodoform in powder, by means of a pepper-caster, has an undoubted antiseptic effect, but with the drawback of an unpleasant odour. It may be conveniently blown into cavities or beneath dressings by the simple apparatus shown in fig. 78.

5. Salicylic acid is used chiefly in the form of lotion and wool or jute. The lotion is a saturated watery solution, and contains about 1 part of the acid in 300 parts of water. This is only used for washing wounds; carbolic acid is employed for the disinfection of the hands and instruments, for the spray, and for washing the sponges.

Salicylic wool or jute is cotton-wool or jute containing salicylic acid, and two different strengths are employed, the material having 3 or 10 per cent. by weight of salicylic acid. Glycerine is generally added to the solution in order to make the crystals stick better to the wool. In applying the dressing a piece of perforated gutta-percha tissue, covered by carbolic gauze, is placed next the wound; over this comes one finger's thickness of the strong wool or jute, and then two fingers' thickness of the weak wool. No mackintosh is required. In some cases where inflammation is present, this dressing is kept wet with the salicylic acid lotion.

A salicylic ointment is used for superficial wounds, and is made in the following manner:—Make a basis of two parts of paraffin to one part of vaseline. Take of this twenty-nine parts, and of powdered salicylic acid one part. Salicylic acid cream, made by mixing salicylic acid crystals with glycerine to the consistence of cream, is very useful for application around a wound where a dressing is to be left on for some days. It prevents and diminishes the eczema which sometimes occurs under these circumstances.

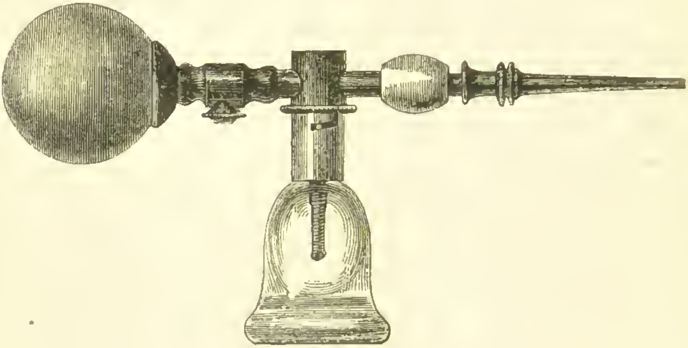

Fig. 78.

6. Eucalyptus oil is a powerful antiseptic, which is useful sometimes as a substitute for carbolic acid. It is chiefly employed in the dressing, the gauze being made with eucalyptus oil instead of with carbolic acid.

It is not so irritating as carbolic acid, and is therefore applied in cases where the acid cannot be borne, but it is not so trustworthy as an antiseptic.

7. Mercuric chloride, in aqueous solution, in the proportion of 1 in 10,000, is a reliable agent for the destruction of micrococci and bacilli in active growth not containing spores ; and in the proportion of 1 in 1,000 it destroys the spores of bacilli, provided that the micro-organisms to be destroyed are fairly exposed to its action for a sufficient length of time. A standard solution of 1 in 1,000 may be safely recommended for the disinfection of bedding and clothing which can be washed, for washing the floors and walls of infected apartments, for disinfecting the hands and instruments of surgeons and gynæcologists, and as a disinfecting wash for superficial wounds or mucous surfaces. For continuous application to wounds &c. a solution of 1 in 2,000 will be effective, and the same solution may be used for the surgeon's hands, but not for instruments, which it tarnishes. This solution is strong enough for wetting the 'guards' and for cleansing a wound during dressing, but for cleansing the skin prior to an operation a solution of 1 in 500 must be employed, after careful washing with soap and water to get rid of grease. Wood-wool wadding, impregnated with $\frac{1}{2}$ per cent. sublimate and 5 per cent. glycerine, is useful.

8. Boracic lotion is a saturated solution of boracic acid in water, but has only feeble antiseptic properties. Boracic lint is ordinary surgical lint soaked in a hot saturated solution of boracic acid, and then hung up to dry ; it must be thoroughly soaked in the warm boric solution before being used, or the crystals will be found to irritate. Boracic ointment of various strengths is also used. The full-strength ointment contains, of the same basis as previously mentioned for salicylic ointment, five parts, and of boracic acid crystals one part. Boracic ointment may also be used of half or one quarter the above strength. Boracic

powder of the thickness of a quarter of an inch forms a reliable antiseptic deep dressing.

In order to keep a wound aseptic, drainage must be provided for, and the fluid draining away must be received into some absorbent and antiseptic material. For this purpose absorbent cotton-wool on which a little iodoform is blown, or cotton-wool charged with salicylic acid, or Sal Alembroth wool or Salufer wool is exceedingly useful. Either of these wools may be conveniently cut into strips with tailors' shears, and be rolled like a bandage for more ready application. The 'Gamgee' absorbent gauze and cotton tissue is a very valuable material, and has the advantage that it can be obtained impregnated with salicylic acid or iodoform. Hartmann's wood-wool wadding or wood-wool tissue, both of which are impregnated with corrosive sublimate, are much used by those who prefer mercurial dressings. Fine carbolised oakum, 'marine lint,' and 'tenax,' which are modifications of the same material, are all good, and may be advantageously enclosed in a layer of Lister's antiseptic gauze, which prevents their becoming entangled in the wound, whilst it does not interfere with the absorption of the discharges. The only drawback is that some skins are too irritable to bear the contact of the tar contained in all these dressings. Pillows of dried 'peat-moss,' as supplied by Krohne and Sesemann, are very useful in absorbing and disinfecting foul discharges and urine.

Skin grafting.—The following is extracted from a clinical lecture on Antiseptic Surgery by Sir J. Lister, to illustrate Reverdin's method of skin-grafting beneath a boracic dressing :—

'The large callous and foul sore, having been dressed for a few days with moist boracic lint covered with gutta-percha tissue, was purified completely by sprinkling the surface lightly with the powder of iodoform, after washing the surrounding epidermis with a strong watery solution of carbolic acid. Prepared oil-silk (protective) dipped in boracic lotion was then applied to the sore, and covered with boracic lint overlapping well in every direction. A similar dressing of oil-silk and boracic lint was applied every third or fourth day, until the granulations had assumed thoroughly healthy characters; when skin-grafting was performed by shaving a thin slice about a quarter of an inch across, consisting of little more than epidermis, from the inner side of the upper arm, which had been washed with 1-in-40 watery solution of carbolic acid, cutting this into small pieces on the thumb-nail, and placing each, with the raw surface downwards, on the granulations, each graft being covered as it was deposited with a little bit of the oil-silk dipped in boric lotion. A general piece of the oil-silk, rather larger than the sore, was then applied, and over this boric lint in two layers, secured with a bandage. This dressing was left untouched for a whole week, so as to allow the grafts a long period without mechanical disturbance.'

Thiersch's method of skin-grafting consists in cutting with a razor, lubricated with glycerine (1 part), absolute alcohol (1 part), and water (3 parts), from the previously carbolised surface of a healthy limb a piece of cuticle as large as required, and this is carefully adapted to the surface of an ulcer which has been brought into a thoroughly healthy condition. The piece of cuticle should be large enough to overlap the edges of the ulcer, or, if necessary, several pieces may be employed, one overlapping the other slightly. Over the grafts a piece of 'protective' dipped in boric lotion is placed, and over it and reaching well beyond a double fold of damp boracic lint, covered with oil-silk and lightly bandaged. The surface from which the grafts are taken may be dressed with boracic ointment.

Drainage-tubes, of india-rubber perforated with holes and kept in a solution of carbolic acid, are useful in many cases, and almost essential in antiseptic dressings to secure the free discharge of secretions. The tubes may vary in size, in proportion to the quantity of discharge anticipated, from the thickness of a crowquill to that of the little finger, and the holes in them should have a diameter about half that of the tube. The outer end of the tube should be on a level with the skin, and it is conveniently maintained in that position by means of two pieces of silk passed with a needle through two opposite points of the edge of the tube, the ends of each thread being knotted at a distance of one or two inches from the tube. These knotted threads being placed straight upon the skin, one at each side, the knots exert friction upon the dressing bound down upon them, and prevent the tube from being pushed in, while the dressing itself keeps it from protruding, so that the orifice lies flush with the integument. When the tube is to be placed obliquely, its outer end must be cut obliquely in proportion; otherwise it is apt to become partially buried and blocked up.

A more satisfactory method of keeping a drainage-tube in position is to transfix it near the end with an ordinary 'safety-pin.' This lies across the wound and ensures the tube being always in action, whereas the threads often allow it to slip within the edges of the wound.

When both ends of a drainage-tube are brought out through the skin, they may be conveniently tied loosely together with a piece of ordinary ligature, and the tube can then be temporarily withdrawn from the sinus for cleansing, and be replaced with the greatest facility. Soluble drainage-tubes of decalcified bone are now to be procured, and are sometimes preferred.

Strands of horsehair, catgut, or silkworm-gut make efficient drains, so long as the discharge is serous, but when it becomes purulent they cannot be relied upon; they all act in a similar manner—viz. by capillary attraction or siphon action, the fluids passing along the fine capillary channels between the hairs, &c. The horsehair should be purified in alkali, and then kept in a solution of carbolic acid (1 in 50). The size of the drain should be gradually diminished as required, by the removal of a few strands from time to time. It is claimed for catgut that it serves its purpose and is then absorbed, and so avoids both the necessity for dressing a wound in order to shorten the tube, and the difficulty of knowing at what rate to do this; and that with it, as with the decalcified bone drains, the theoretical perfection of one dressing only from first to last is possible. It should, however, be admitted that, owing to the swelling of the catgut and its incorporation with the tissues, its efficiency as a drain may be interfered with too soon, whilst in other cases it remains unabsorbed after it has ceased to be required.

Evaporating dressing.—The advantage of this is the constant maintenance of a low temperature in the affected part. It is applied in the simplest form by placing a piece of doubled lint upon the wound, and letting the patient or nurse keep it constantly wetted with water or an evaporating lotion. To be of any service, the surface of lint must be fully exposed to the action of the atmosphere—a fact which is very commonly ignored, the part being carefully covered with the bed-clothes. Care should be taken to protect the bedding and the rest of the patient's body from getting wetted, by the judicious application of waterproof sheeting.

Irrigation is a more perfect method of lowering the temperature of the part, and has a direct tendency to prevent the occurrence of inflammatory action, provided the application of it be sufficiently prolonged;

for if irrigation be suspended after a short time, the reaction will only be all the greater and the inflammation more severe. Irrigation, then, to be of any service, must be continued until all danger of inflammatory reaction is past and the wound has put on a healthy appearance. It may be most simply accomplished by placing a vessel containing water (iced) slightly above the level of the patient's bed, from which a piece of cotton-wick or skein of worsted can conduct the fluid, after the manner of a siphon, to the affected part. This should be covered with a piece of lint, into which the water may soak, and waterproofs should be arranged so as to protect the bed, and also to conduct the water into a suitable receptacle below. The siphon may be formed of gutta-percha or tin tubing if preferred; or the nasal douche shown in fig. 1 may be employed, with a common hairpin placed across the tube to regulate the flow; or a pipe and stopcock may be fitted to the bottom of a tin can, which is to be suspended directly over the injured limb.

The same form of apparatus may be used when it is desirable to have a stream of tepid or warm water constantly flowing over a part, as in crushes, gangrene, &c.

A more satisfactory way of lowering the temperature of a part is applying dry cold by means of an india-rubber ice-bag, or Leiter's coil of metallic tubing, which can be readily adapted to any part of the body, or, if preferred, to the head, and through which a constant current of iced water can be maintained.

Ointments are to be applied on lint, and should be well worked up with the spatula before being spread, in order that their surface may be smooth and even. Some surgeons lay great stress upon the selection of the right side of the lint for the reception of the ointment, and differ as to which *is* the right side. The soft flocculent side would appear the more reasonable, since, if the other is used, the lint possesses no advantage over ordinary linen.

It is claimed for greasy dressings that they are more readily detached from a sore, and thus cause no pain to the patient, nor occasion any hæmorrhage. This is no doubt the fact; but water dressings, if properly wetted, are as readily detached, and any one who has contrasted the appearance of sores dressed by the two methods, under precisely similar circumstances, will not hesitate to give the preference to the water dressing.

Fomentations.—When the skin of the inflamed part is not broken, soft flannel wrung out of boiling water, or spongio-piline similarly treated, makes a good fomentation; but if the inflamed area be also wounded, antiseptic fomentations are preferable. Two or three folds of boracic lint, or a thick piece of salicylic wool, or a handful of oakum steeped in boiling water and thoroughly wrung out, make admirable antiseptic fomentations. Whatever material is used, it must be covered over with a piece of oil-silk or mackintosh cloth of larger size than itself, in order to retain the moisture; and this, again, must be covered with a thick layer of cotton-wool, in order to retain the heat; the whole application should be fixed in position by some form of bandage which is easily applied and readily removed without causing the patient much disturbance. For the limbs the many-tailed bandage is the best. The external covering of cotton-wool is most important, for without it the heat of the fomentation would be quickly lost, and even with it the loss is so rapid that it is desirable that fomentations should be changed every hour or two hours.

Fomentations should be wrung as dry as possible, for they can then be borne by the skin at a higher temperature than when the moisture has not been so thoroughly expelled.

To make a fomentation the cloth should be placed in a 'wringer,' consisting of a piece of stout towelling with a rod at each end, and boiling water poured over it into a basin ; the fomentation should then be squeezed dry by twisting the rods in opposite directions ; in the absence of the wringer an ordinary towel answers very well. The fomentation should be carried to the patient in the wringer and at once applied.

Fomentations are often used as vehicles for applying other therapeutic agents : thus, if a strong counter-irritant effect is desired, twenty or thirty minims of turpentine may be sprinkled on the fomentation ; if an anodyne effect be required, one or two drachms of the tincture of opium or belladonna may be sprinkled on the fomentation, or equal parts of the extract of belladonna and glycerine may be first smeared over the inflamed part, and then the fomentation be applied. In some cases the effect of heat without the relaxation of tissue produced by an ordinary fomentation is desired ; and then bran, chamomile heads, or sand heated in a pan over the fire and poured into suitable bags, may be applied over the affected parts. These applications are especially effective in relaxing muscular spasm and relieving its attendant pain.

Poultices.—Linseed-meal is the one in common use, and the meal should be made from the crushed seeds, without any of the oil having been expressed.

The house-surgeon, although not often called upon to do so, should be able to make a poultice, which in no respects resembles the 'dab' of half-dry brown material to which patients are in the habit of applying the term.

A piece of linen rag will be required, two inches larger each way than the intended poultice. This being spread upon a board or table, a quantity of meal, slightly larger than will be actually required, is to be put in a basin which has been scalded out, and *boiling* water poured into it, a little at a time, until the mixture, which is to be well stirred, is brought to the consistency of thick porridge. It is then to be turned out of the basin upon the cloth, and spread with a large spatula or knife to the thickness suitable for the case (from a quarter to three-quarters of an inch). The sides should now be neatly squared off about an inch from the margin of the rag all round, by cutting off the superfluous matter with the edge of the spatula, and each margin of the rag should then be doubled upon itself, and afterwards folded over upon the meal, thus forming a neat edge to the poultice, and preventing the escape of the meal or of the discharge from beneath it.

If the water was boiling, and the preparation has been performed with proper activity, the poultice will be quite as hot as the patient can bear ; but if it has at all cooled, it should be held to the fire for a few moments to restore the temperature.

A poultice should not be 'clapped on' a tender surface, but one end being gently laid on, the rest should be gradually allowed to cover the wound ; and similar precautions should be observed in removing a poultice. A piece of oil-silk, or what is cheaper, oiled calico, should be placed outside a poultice, in order to retain the heat, and the whole must be kept in position with strips of plaster or a light bandage.

A little olive oil spread upon the surface of the poultice prevents the possibility of its adhering to the part on which it is applied, and it is advisable where the ordinary linseed-meal is used, though not absolutely necessary. Some persons recommend that a piece of fine muslin should intervene between the poultice and the sore ; but by that arrangement the poultice loses nearly all its power. It may be advisable, in the case of boils &c., to limit the action of the poultice to the exact locality of the disease, and this can be readily done by cutting a suitable hole in a piece of soft linen, which may be placed over the affected part and beneath the poultice. A poultice may be advantageously rendered aseptic by sprinkling the surface with iodoform.

Bread poultice is seldom used in hospital practice, and it is not so efficient or comfortable as the linseed. It is made from the inside of a stale white loaf, well crumbled, upon which boiling water is poured. This is to be covered and allowed to stand for a few minutes, when the water is to be strained off, and the resulting pulp to be spread with the spatula.

Charcoal poultice is directed by the British Pharmacopœia to be made of bread linseed, and powdered wood charcoal, but the bread is an unnecessary addition. The powdered charcoal had better be *animal* and not vegetable, which has a much smaller disinfecting power.

Yeast poultice (B.P.) is made by adding yeast to a mixture of flour and water and letting it stand before the fire until it rises. It is an uncomfortable application, and possesses no special advantage.

Poultices of different characters may be readily prepared by adding suitable drugs to the ordinary linseed poultice : thus, the tinctures of opium, henbane, or hemlock, or the *liquor sodæ chloratæ*, may be selected for each variety of case.

Oakum poultice is a very useful application for keeping up fomentations around a limb, particularly when there are discharging openings which it is important to keep sweet without any accumulation of the discharge. It is made simply by taking a sufficient quantity of loosely picked oakum and wringing it out of hot water with a twisted cloth. It is then conveniently placed in a fold of antiseptic gauze to prevent its adhering to the wounds, and applied as hot as the patient can comfortably bear it. A mackintosh sheet should be folded over it and the limb in order to keep in the heat and moisture.

Strapping.—The common adhesive strapping answers perfectly for all ordinary purposes; but should it be too irritating to the patient's skin, the soap plaster may be substituted for it; and in cases of disease of joints &c. it will be well to employ stout twilled calico plaster, which is much stronger than the common strapping. In some cases it may be advisable to substitute the opium or belladonna plaster where an anodyne effect is wished for, or the pitch plaster when counter-irritation is required.

The india-rubber plasters of American origin, and made in this country by Mather, have the great advantage that they are impervious to moisture, and therefore do not become loose when wetted. They are generally faced with muslin to prevent their sticking together, and this must be removed before the plaster is applied. If the muslin adheres inconveniently it is only necessary to wet it, when it can be readily removed.

Strapping being mainly used to support the tissues, it should always be cut in the length of the piece of calico, so that it may not *give*, as it infallibly will do if cut in the opposite direction. When applied to hold the edges of the wound together, the strapping should be long enough to go for some distance on each side, so as to take a firm hold of the tissues; and in some cases of wound it will be well to carry it quite round the limb, as will be shown in strapping an ulcerated leg. The edges of a wound should be held firmly together while the plaster is applied; and as a rule the traction of the plaster should be *upwards*—*i.e.* it should be affixed to the lower edge of a wound first. In removing strips of plaster from a wound, care should be taken not to drag it open, and to avoid this the strap of plaster should be lifted up at the ends and drawn gradually to the centre, whence it may be gently detached at last.

In ordinary wounds where other dressings are to be applied, not more than one or two strips will be required ; but in exposed situations (as the face), where other dressings cannot be conveniently applied, the strapping may be made to cover the wound entirely, being cut in small strips, which should partially overlap one another, and these may be again crossed by others if necessary.

Where traction is required, as in plastic operations, it will be found convenient to use two strips of plaster of different widths, the narrow one passing through a transverse slit in the broader one, so as to allow of the parts being forcibly drawn together (fig. 19).

Ordinary strapping is soon decomposed by the secretions of a wound, and turns black from the lead it contains, and the part to which it is applied is often discoloured in the same way. This may be at once removed by gentle friction with a little olive oil or vinegar, and the subsequent application of soap and water ; and in the same way the house-surgeon may clean his sticky fingers more readily than with turpentine, as usually recommended. Plaster is readily warmed by holding it with the *plain side* against a hot-water tin, with which the operating-theatre, surgery, and each of the wards should be provided ; or, more efficiently, by dipping the straps *into* the hot water for a minute or two. When treated in this way the plaster lies much more smoothly, and can be more readily adapted to an irregular surface. A cloth should be used to soak up the superfluous moisture after the plaster is applied, and to press it close to the limb. When required to be applied beneath a Listerian dressing the plaster must be dipped in hot carbolic solution (1 in 20). Before using a sheet of plaster it should be wiped briskly with a dry cloth, to get rid of the dust and particles of plaster which collect on the surface.

To strap a limb.—The leg is the limb most frequently strapped, for the treatment of varicose ulcers &c. ; but the arm might, if necessary, be treated in precisely the same way. The straps should be one inch wide, and about twenty inches long, and should be applied from two inches below to at least the same distance above the ulcer ; and where the veins are much enlarged, the strapping may be carried further up the limb with advantage. The heel being raised upon a stool, the surgeon, facing the patient, passes a well-warmed strap under the limb, and applies the middle of it to the back of the leg, then brings the ends over the sides of the limb and crosses them in front, the direction of the ends being upwards, so as to accommodate the inequalities of the limb, and enable the strapping to lie perfectly smooth without any snipping. The next strap is put on in the same way, but is made to overlap the first for a third of its width, and so on throughout (fig. 79). In drawing the ends of the strap forward, care must be taken to exercise sufficient but not too great traction, lest the patient should be unable to bear the pressure, and the whole thing have to be undone. It will be observed in the illustration that the *ends* of the straps are not seen, they having been carried on towards the back of the limb ; and the straps should always be cut sufficiently long to pass, as in this instance, well beyond the margin of the ulcer.

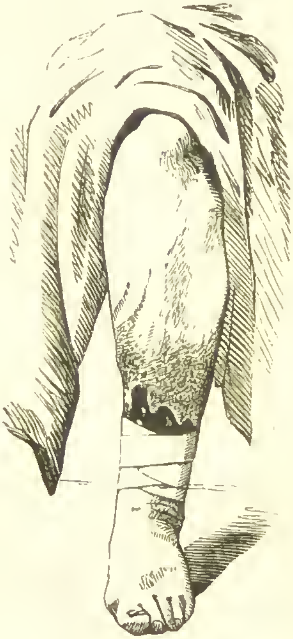

Fig. 79.

In removing strapping from a limb or joint, it saves both time and trouble to pass a director beneath it, and lay it open with a pair of scissors, and so remove the whole at once, instead of pulling off each strap separately.

To strap a joint.—The ankle or knee most commonly requires the application of strapping, either alone or conjoined with other applications.

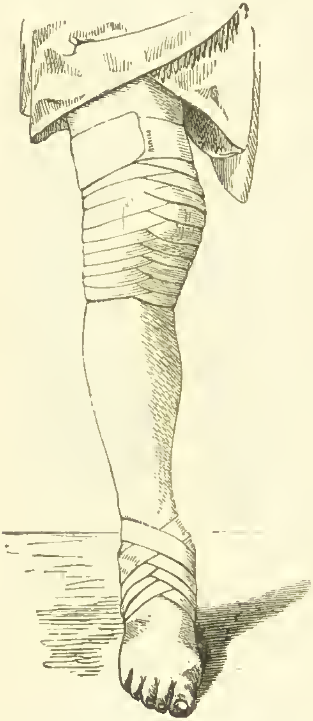

FIG. 80.

Ankle.—The strapping should be carried from near the roots of the toes to a couple of inches above the ankle-joint, and should be begun under the sole and crossed over the instep, as far as possible towards the heel. A second set of straps must then be carried up behind the tendo Achillis, so as to embrace the malleoli and cross on the instep, and thus the whole joint will be covered—the heel being left exposed, which is an advantage rather than otherwise (fig. 80). In order to make the plaster lie smoothly on the inequalities of the joint, it will be necessary to snip the edges in various places, and smooth each strap with the palm of the hand before applying another.

Knee.—Twilled calico plaster, or soap plaster spread upon wash-leather, is the most suitable for strapping the knee or elbow. The straps are to be applied in precisely the same way as upon the leg, and must be long enough to reach thoroughly round the joint and cross in front (fig. 80).

Scott's dressing consists in the application of strips of lint spread with mercurial ointment (Ung. Hydrargyri Co.) in the same way as the straps, which are then to be applied over the lint so as to make pressure on the diseased joint; they should be carried for a short distance below and above the lint, so as to take a firm hold of the limb.

To strap a testicle.—One or two methods have been described, but the following will be found simple and efficient. It is essential to shave off all the hair from the pubes and scrotum of the affected side; and the operator, sitting in front of his patient (who should stand with his back against the wall), is then to grasp the enlarged testis with his left hand and separate it from its fellow, pushing it well down to the bottom of the scrotum. A strip of wash-leather plaster is then to be applied immediately above the testicle as tightly

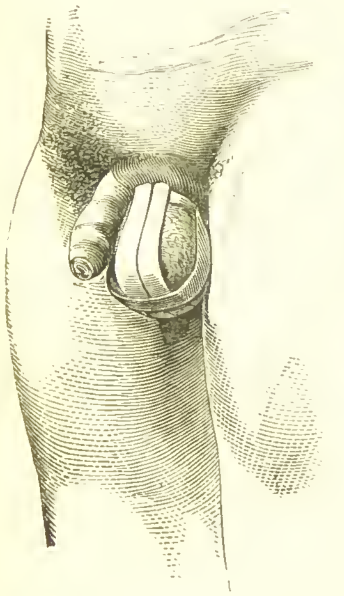

Fig. 81.

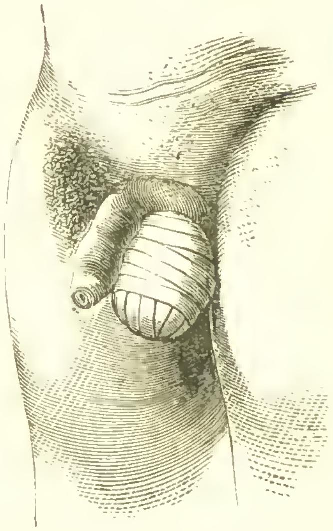

Fig. 82.

as it can be borne, so as to prevent the gland slipping up again, and this strip should go twice round ; or if the plaster is not at hand, a piece of lint may be put beneath common strapping to protect the skin. Strips of ordinary strapping, half an inch wide, are then to be cut of sufficient length to reach from the ring of wash-leather vertically over the testis and back to the same point on the opposite side, and these should be applied all round so as to envelop the testis completely. The simplest way is to apply one or two in front first, and then similar ones at right angles, as is shown in the engraving (fig. 81), and afterwards to fill in the intervals. A long strip of plaster, half an inch wide, is then to be wound horizontally over the other straps, beginning from as near the bottom of the testicle as convenient, and carrying it up over the original wash-leather ring, so as to envelop the testis and keep all the vertical straps from slipping (fig. 82). Three or four of these long strips will probably be required.

So long as compression is effected, the regularity of the strapping is a matter of secondary importance, and the house-surgeon must not be disappointed if he is unable to produce the picturesque appearance which is given in drawings *not* taken from nature. In a day or two the testicle will be found to have shrunk so that the strapping forms a loose bag around it, and will require a repetition of the application.

To strap a breast.—This is one of the most efficient modes of giving support to an inflamed or enlarged breast, and has the advantage over the bandage of not getting loose. The straps should be from one and a half to two inches wide, and about thirty inches long : and the breast being held up by an assistant, the end of a strap should be firmly attached just above the spine of the scapula of the opposite side, then brought over the clavicle, under the diseased breast, across the axilla, and round to the back again (fig. 83). The first strap should go just below the breast; the next, slightly overlapping it, should go a little higher; and so on towards the nipple, until the necessary support is given; additional straps being brought down from the shoulder of the affected side if required. If *compression* is desired as well as support, cross straps may be brought from the upper part of the axilla of the affected side above the nipple, to end below the opposite arm.

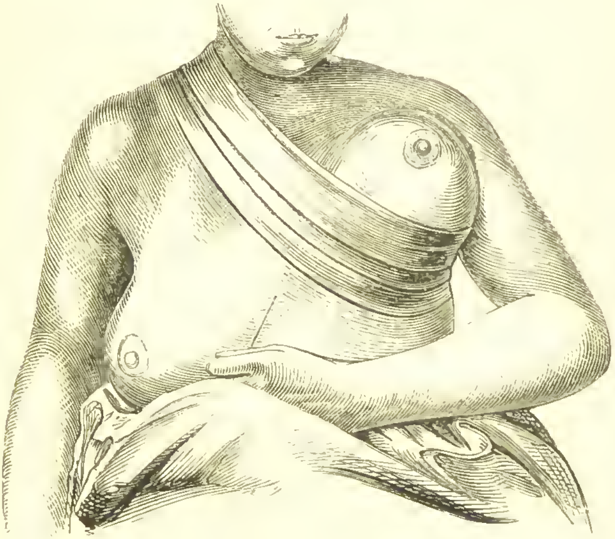

FIG. 83.

Strapping in fractures, &c.—Besides the above ordinary uses of strapping, it will be found a most useful adjuvant in the treatment of fractures, deformities, &c., both by fixing splints and apparatus more firmly than can be effected by bandages alone, and by giving the power of effecting traction upon a limb without exercising compression, which is often a matter of great importance.

For this latter purpose, now usually employed by extension with a weight, the common strapping cannot be relied on, and plaster made of stout jean or brown-holland should be preferred.

CHAPTER VIII

BANDAGES

A THOROUGH knowledge of bandaging is essential for a house-surgeon, and can only be attained by constant practice. The material used for bandages varies slightly at different hospitals, but generally consists of coarse unglazed calico, torn in lengths of from seven yards upwards, and of several widths to suit different purposes, the most commonly used being two and a half inches wide. A more elastic and cooler material is the gauze bandage, sometimes called water-dressing bandage. The double woven-bandage known as Churton's is quite unfit for surgical purposes, though commonly supplied by chemists. A bandage should be firmly and evenly rolled ; for unless this is done it is impossible to apply it to a limb properly ; and this may be accomplished either by hand, or better, by one of the little machines invented for the purpose, of which the illustration (fig. 84) represents one of the neatest (made by Aitken, of York), which may be readily attached to a table or bench when in use.

Martin's india-rubber bandage, as imported by Krohne and Sesemann, is useful when support and moisture are required, as in certain cases of eczema and ulcer of the legs, but is too hot for general wear in cases of simple varicosity. It must be applied as a spiral bandage, and just tight enough not to slip down. The bandage should be removed at night, and having been sponged with cold water, is to be hung over a line to dry, or it can be wiped dry at once and rolled up with the tapes in the centre.

Bandages are called single-headed or double-headed rollers, according as they are rolled in one or two parts, the former being the ordinary method, and always intended in the following pages unless the contrary is expressly mentioned.

The following will be found to include all the bandages which can be required in the ordinary practice of surgery; minute subdivisions and useless complications having been purposely avoided. If a surgeon is fully acquainted with all here described, he will find no difficulty in adapting his bandage to any out-of-the-way case which may occur to him.

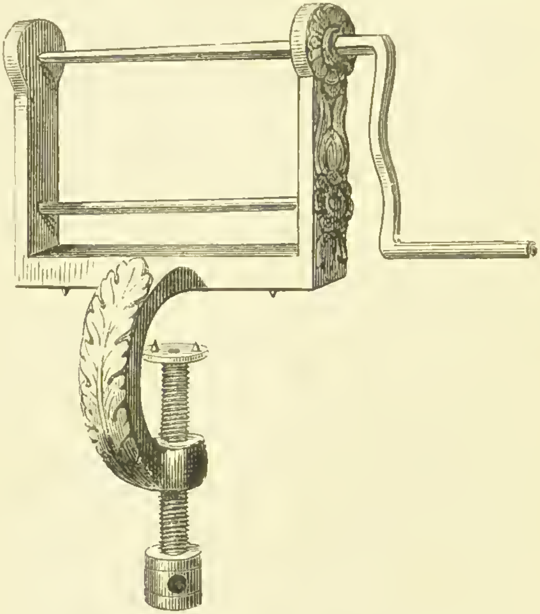

FIG. 84.

In applying any bandage the operator should grasp the roll in one hand, and taking the loose end in the other, apply it to the limb so that the *outer surface* may be against the skin, by which the roller, as it is being carried round, will always lie close to the limb, and the bandaging will be much neater than if applied in the contrary way.

Spiral bandage.—The nature of the spiral bandage is indicated by its name, and it consists in covering a limb by a series of spiral turns, each overlapping the one below for about one-third of its width. In practice, however, owing to the enlargement of the limbs at the upper part, it is impossible to apply this bandage without making 'turns' in it—*i.e.* folding the bandage upon itself so as better to accommodate the shape of the limb. To make these turns neatly is the difficulty which besets the beginner, but if he attends to the following rules a little practice will soon overcome it :—1st. A turn should never be made over a prominence of bone, and, where possible, should be on the outside of a limb. 2nd. However tightly the bandage may have been drawn before, at the moment of making the turn it should be held quite loosely, when with one movement of the wrist the required turn may be made, and can afterwards be pulled as tight as may be necessary. (It is sometimes recommended to lay the forefinger or thumb of the opposite hand upon the bandage at the point where the turn is to be made, and to fold it over the finger, but if the above rule of holding the bandage quite loose is attended to, there is not the least necessity for so doing.) 3rd. In making the turn the hand should be held slightly above the level of the limb, and care be taken not to unroll more bandage than is actually required for its performance.

Figure-of-eight bandage.—The nature of this is also indicated by its name, and being formed without any turns, its application is easier than that of the other variety.

The spiral is most applicable to the surface of the limb, while the figure-of-eight is peculiarly adapted for the joints. Either may be applied separately, as in the accompanying drawing, where the right leg (fig. 85) was bandaged with the spiral alone, and the left (fig. 86) with the figure-of-eight alone. It will be observed, however, that the spiral does not fit well around the ankle, while the figure-of-eight would have been very difficult to apply smoothly over the swell of the calf. A combination of the two is the best, as seen in

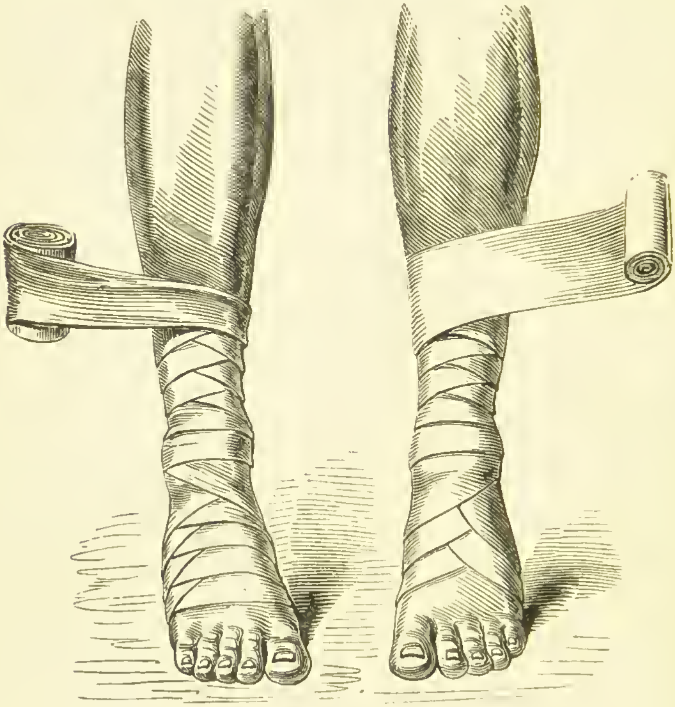

Fig. 85. Fig. 86.

fig. 87, where the spiral is used in the foot, the figure-of-eight round the ankle, and the spiral is begun again (at first plain, and afterwards with turns) in the leg.

It will be observed (in figs. 85 and 86) that the appearance of the two bandages is almost precisely similar; so that a skilful manipulator would carry his bandage from the toe to the groin, using the figure-of-eight over the ankle and knee, and the spiral over the limbs, without in any way interfering with the uniformity of its appearance.

In order to render the method of bandaging uniform, it is recommended to bandage *from* the inside of a limb, and thus bring the turns to its outer side. The operator, in order to do this while in front of his patient—the proper position—must be able to bandage equally well with both hands (an art easily acquired); for he will require to bandage the right leg with the left hand, and *vice versâ.* This method is, of course, not absolutely essential, but enhances considerably the symmetrical appearance of the bandages.

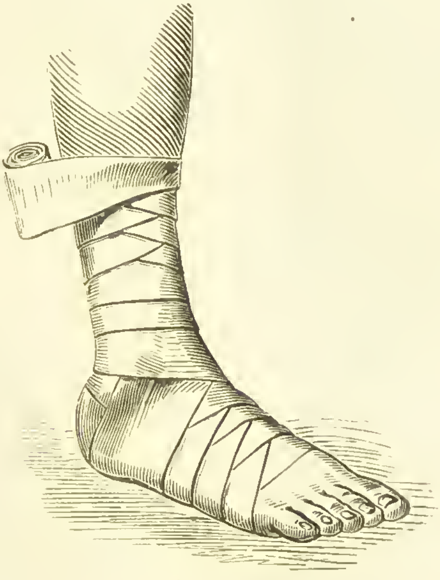

Fig. 87.

To bandage the leg.—To fix the bandage firmly (a most important point) a figure-of-eight turn should be made around the ankle, the foot being raised to a convenient height upon a stool. If it is desirable to bandage the foot, a few spirals and turns (fig. 87) may then be made over it, beginning at the roots of the toes ; but if not, the bandage should take another figure-of-eight turn at once, overlapping the former by about one-third of its width. This will give the bandage sufficient 'spring' up the leg, and the spiral folds may be at once begun, the first two or so being plain, the turns then commencing on the outer side of the leg, and being continued as high as the bandage goes. In simply bandaging the leg it is usual to leave the heel exposed ; but if for any reason it is desired to cover the heel, a series of figure-of-eight turns over the back of the foot and behind the heel must be made, so as to cover the heel from below

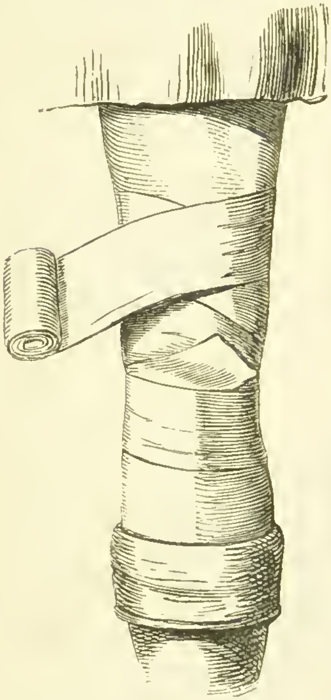
Fig. 88.

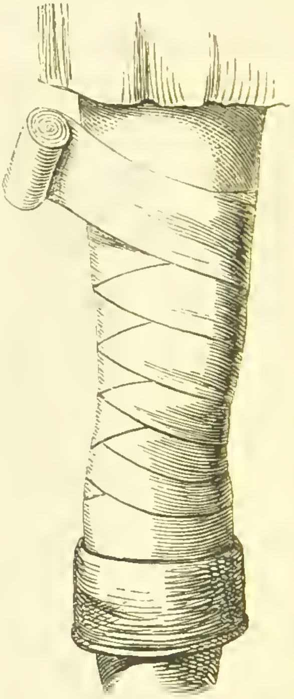
Fig. 89.

upwards, each turn of bandage overlapping that preceding it for half its width ; or the bandage may be begun over the heel and carried upwards and downwards alternately.

To bandage the ankle.—The method of applying the figure-of-eight to this joint is sufficiently explained in the above paragraphs (fig. 87).

To bandage the knee.—The figure-of-eight is to be used for this, but its application requires some little care, or it will be found to slip. In order to fix the end, supposing the bandage has not been brought up the leg, it should be laid across immediately below the patella (fig. 88), and the bandage be carried round the limb below the knee, so as to cross itself. The roller is then carried behind the ham to the inner condyle, and makes a loop embracing the thigh immediately above the joint ; it is then brought behind the ham again to the inner side of the joint, and made to overlap the former loop neatly ; then around the femur again, but lower than before, so as to make the next loop fit in properly, and so on, till the appearance of fig. 89 is produced, where the original loop round the femur is completely hidden by the folds of the figure-of-eight loops applied over it.

To bandage the groin : spica.—This useful bandage is best applied while the patient stands, the surgeon being in front of him (fig. 90). The bandage is to be carried along the groin of the affected side, from within outwards, and over any pad which it may be desired to hold there ; then to pass round the pelvis, and back over the pubes, crossing the former fold at the groin, and then completing the figure-of-eight round the thigh. A series of similar turns, each slightly overlapping the other, may then be carried round in the same way, until the part is covered and sufficient compression produced. The amount of compression in the groin may be easily regulated by increasing or diminishing the size of the pad, to which the bandage may be secured by a couple of stitches, or a safety-pin.

To bandage both groins: double spica.— Beginning in the same way as in the single spica, the bandage is carried over the right groin, then around the pelvis, and (fig. 91) brought over the left groin to form a loop on the left thigh. It is now carried across the abdomen to the right side, and encircles the body at the waist, whence it traverses the abdomen again to the right groin, crossing the commencement of the bandage there, and passing round the right thigh. A series of turns of this description will effectually cover both groins, as seen in the figure.

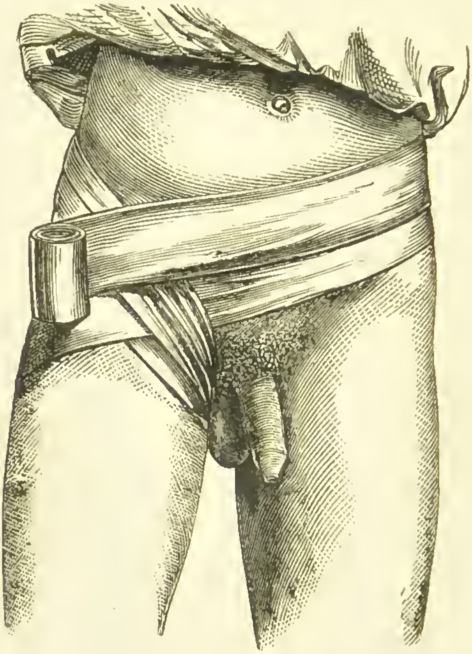

Fig. 90.

It must be noticed that the turns 'round the pelvis' should be kept strictly below the brim of the pelvis, but that those 'round the waist' will be at the level of the umbilicus, since the integrity of the bandage depends very much upon this being fully attended to.

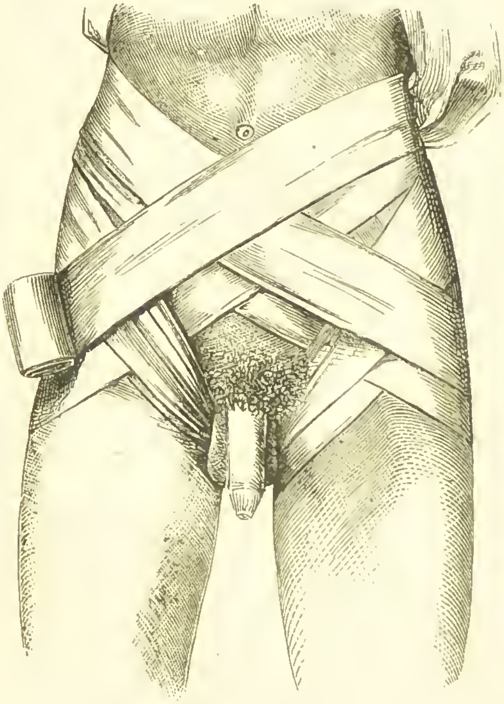

Fig. 91.

To bandage the perinæum and pubes.—The following method is useful for keeping antiseptic dressings on the perinæum and pubes without interfering with the natural functions of the part. It is familiarly called the 'St. Andrew's Cross' of the perinæum, (fig. 92).

The bandage, after a turn round the body, passes down obliquely across the left groin, then behind the left thigh, just below the fold of the nates, and obliquely upwards across the perinæum, and through the right groin, towards the right iliac spine. It then passes around the body behind, and from the left iliac spine obliquely downwards along the left groin to cross the perinæum, and go below the gluteal fold on the right thigh, and so on round the body again. In this way the bandage crosses in both groins and over the perinæum, and antiseptic gauze or wool can be thoroughly kept in position in each region, the penis projecting through an opening in the dressing.

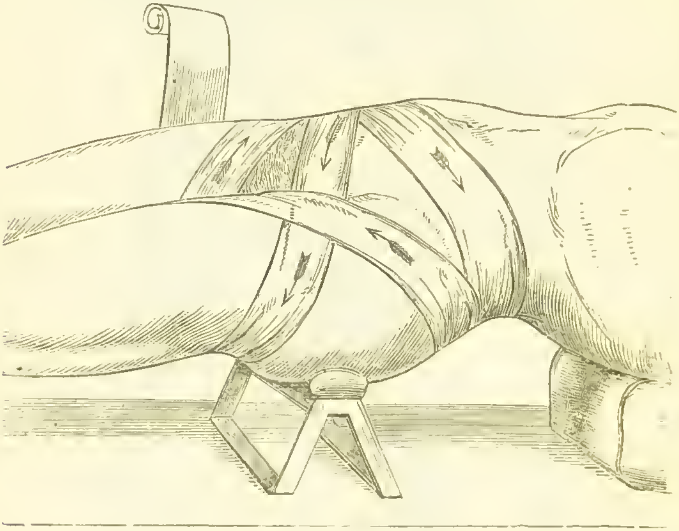

FIG. 92.

After an operation for hernia, the deep dressing having been applied according to the fancy of the surgeon, a superficial dressing large enough to cover the lower part of the abdomen and the adjacent parts of the thighs should be applied, with a hole through it for the passage of the penis. A good roll of wool should be placed beneath the scrotum to efficiently support the testicles and prevent the possibility of infection from the anus. To efficiently maintain this dressing a spica bandage (fig. 90) should be applied to each groin, followed by the perineal bandage already described (fig. 92). Over all a piece of waterproof hat-lining, the size of the superficial dressing, and with a corresponding hole for the penis, should be carefully secured with a sufficient number of safety-pins, so as to obviate the possibility of urine finding its way into the dressings.

Volkmann's pelvic rest (fig. 93) is useful for supporting the pelvis in all cases in which bandages have to be applied to a patient in the horizontal position.

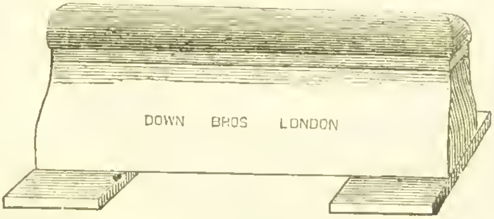

FIG. 93.

To bandage the breast.—A couple of turns are to be taken round the waist, immediately below the breast, in order to fix the bandage, which is then to be carried under the affected organ and over the opposite shoulder; then around the waist, so as to fix the former turn, and next under the breast and over the shoulder again, and so on alternately until the breast is sufficiently covered and supported.

In the drawing (fig. 94), the bandage is only partially applied, and it will be seen that, at the last, two turns have been successively made under the breast, and this will often be found advisable. The next turn would go round the chest above or below the opposite breast, and so on, as high as might be necessary.

To bandage both breasts (fig. 95).—Beginning around the waist as before, the bandage is taken under the left breast and over the right shoulder, and

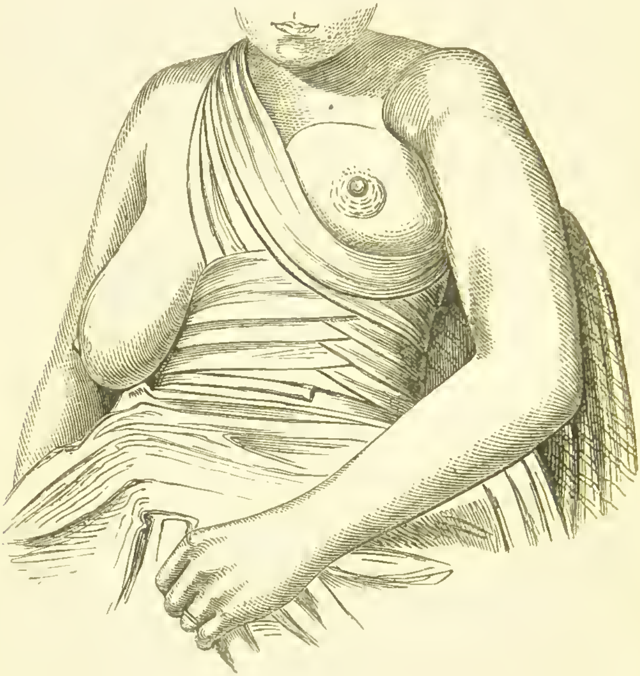

FIG. 94.

then half round the waist again to fix the turn ; next across the back to the left shoulder, across the chest and under the right breast and round the back to the left side. The next turn is under the left breast and half round the chest, and so on alternately, the folds being applied on the left from below upwards, and on the right from above downwards, and crossing alternately on the front and back of the chest. The order would, of course, be reversed if the bandage were applied in the opposite direction round the waist at first, and it is immaterial which method is followed.

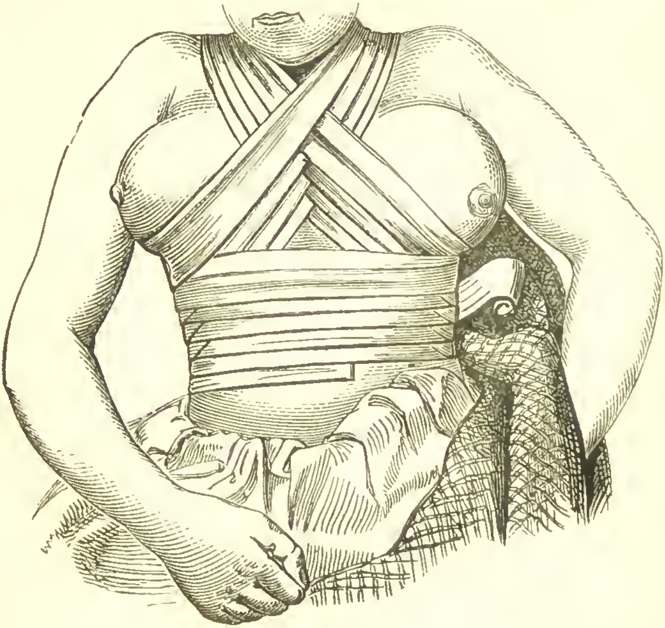

FIG. 95.

Bandage for dressing after removal of breast.—The Listerian method of dressing may be employed after removal of the breast, but many surgeons prefer the less complicated dressing of iodoform and salicylic wool. In either case the following bandage will be found serviceable (fig. 96). The arm, shoulder, and back, as well as the immediate neighbourhood of the wound, being enveloped in antiseptic wool, a couple of turns of the bandage are taken round the chest and arm, and the bandage is then carried round the trunk so as to fix the lower edge of the dressing both in front and behind. The bandage is then carried over the shoulder of the affected side, where it is secured with a safety-pin, and down the back of the arm beneath the elbow. It is then taken over the opposite shoulder so as to support the elbow, and crossing the back obliquely (where it should be fixed with a pin),

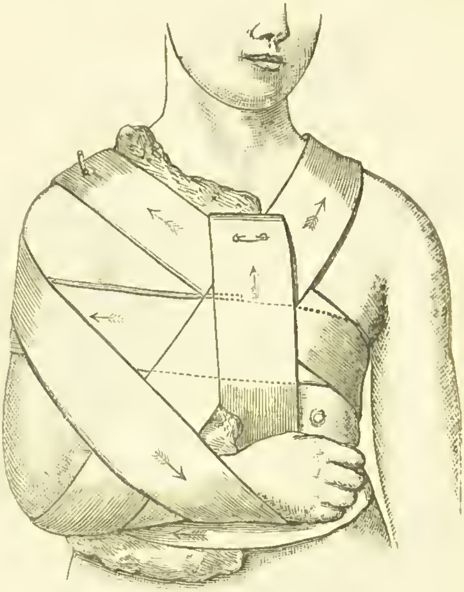

Fig. 96.

is brought forward obliquely to go beneath the hand and end in front, where it is secured with a pin.

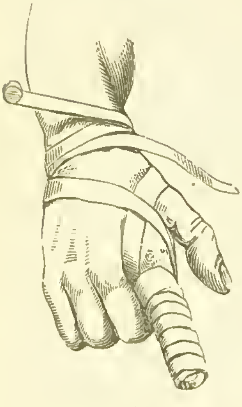

Fig. 97.

To bandage the finger (fig. 97).—A bandage three-quarters of an inch wide will be most convenient, and a couple of turns (leaving out a loose end) should be made round the wrist. The bandage is then brought over the back of the hand, and taken in a series of spirals to the tip of the finger, which it surrounds, and is brought back by regular spirals in the opposite direction to the root of the finger again; crossing the former bandage on the back of the hand, it finally surrounds the wrist, and can be finished off by making a knot and bow with the loose end.

The penis may be bandaged in a similar way, but it will be sufficient generally to commence at the root of that organ, without going round the groins.

In applying simple dressings to either finger or penis, it will be sufficient to twist a piece of lint round a few times, after the manner of the above bandage, and to finish off by splitting the lint and tying the two ends around the part.

To bandage all the fingers.—The bandage is carried round the wrist, and then spirally over the little finger, as described above; it then passes round the wrist, and down to the ring finger and back to the wrist, and so to each finger and the thumb successively, as seen in fig. 98. This bandage is used when, in cases of fracture of the upper arm &c., it is thought advisable to bandage the hand to prevent œdema, and is also applicable in cases of wound of the palm.

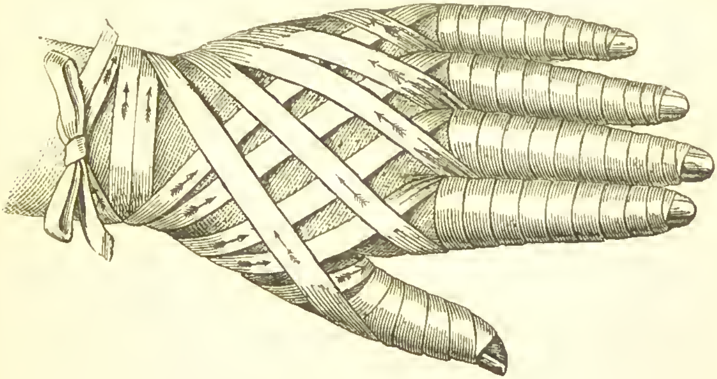

Fig. 98.

To bandage the thumb: spica of thumb.—A bandage, about three-quarters of an inch wide, should be fixed round the wrist by a couple of turns from within outwards, and is then to be brought over the back of the thumb to the lower part of the first phalanx, around which it is to form a loop. Then crossing itself at the phalanx, and passing over the back of the hand, the bandage will arrive at the outer side of the wrist, under which it is to pass, to descend

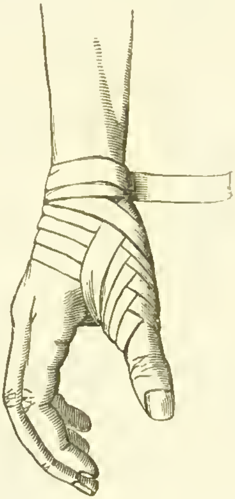

Fig. 99.

upon the thumb and form another loop, slightly overlapping the former one, and so on until the appearance given in fig. 99 is produced. The bandage is to be finished off by two or three simple turns round the lower end of the forearm.

This bandage is very useful in maintaining pressure upon the ball of the thumb in cases of wound attended with smart hæmorrhage.

To bandage the hand and arm.—The roller is fixed by a figure-of-eight turn around the metacarpus and wrist, and the bandage commenced as near the fingers as desirable, by a series of figure-of-eight turns (fig. 100) passing over the back of the hand, under the wrist, and down again over the root of the thumb, thus crossing on the back of the hand in regular succession. As soon as the bandage is brought fairly above the wrist, a few plain spirals may be applied, and the turns may then be commenced and carried along the outside of the arm. Around the elbow-joint the figure-of-eight turns should be resumed and applied as on the knee, or as figured in the application of a bandage after venesection (p. 126), and the turns may be again resumed in the upper arm. If it should be desirable to include the fingers at the same time as the arm, this will be best accomplished, first, with a small spiral bandage, as shown in fig. 98, and the above can afterwards be applied over it.

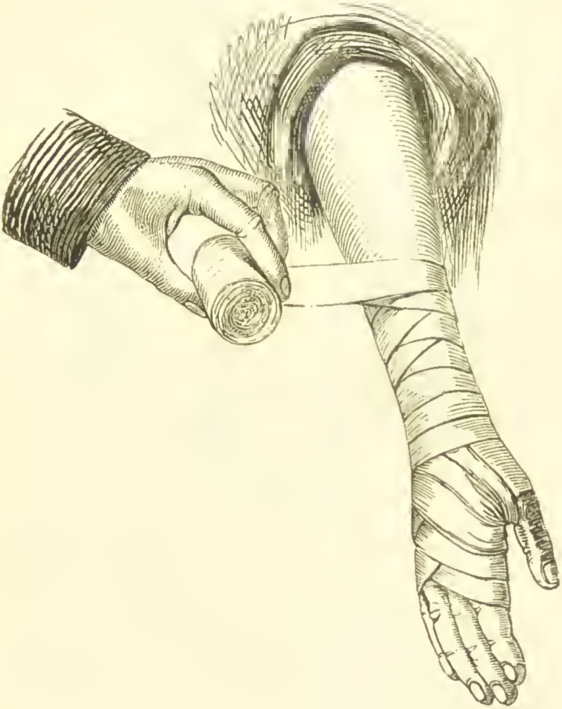

FIG. 100.

Bandage for the axilla: spica of shoulder.—The bandage is brought from within outwards through the axilla, and over the pectorals to the top of the shoulder. It next forms a loop around the root of the neck, and, crossing itself, is brought behind the shoulder to the axilla again. These figure of-eight turns may be repeated as often as necessary, and may either ascend or descend as may be found most convenient.

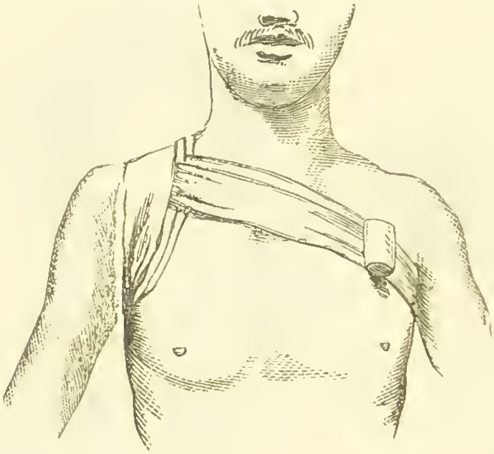

FIG. 101.

This bandage may, if it is preferred, be carried under the opposite arm instead of round the neck (fig. 101). It will be commenced in precisely the same way, and the crossings will similarly be on the top of the shoulder.

Bandage for the neck: spica of neck.—In order to keep dressings on the neck after operations in that region, the following bandage (fig. 102) will be found serviceable. Beginning on the shoulder, the bandage is taken through the axilla and round the neck once or twice (spica of shoulder). The next turn is taken round the neck and beneath the jaw over the top of the head, and is repeated two or three times, thus completing the spica of the neck. Lastly, the bandage is carried round the forehead so as to fix the other turns. A few safety-pins, judiciously placed, will keep the turns round the neck from slipping up, and maintain the continuity of the bandage.

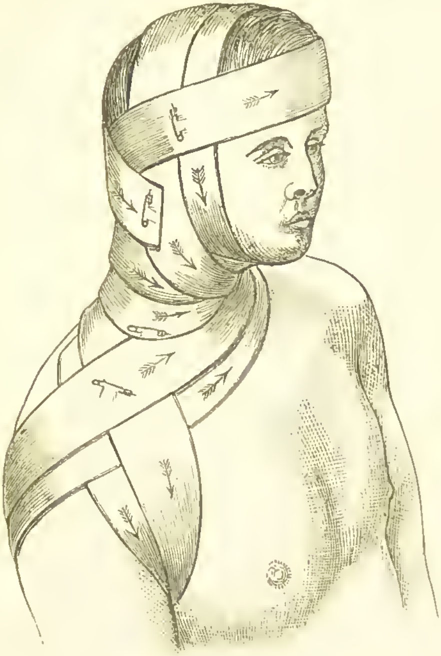

FIG. 102.

Bandages for the head.—The simplest form of bandage for the head consists of a couple of turns round the forehead and occiput, but this is very apt to slip up unless conjoined with a turn under the chin (fig. 103). The circular portion is to be fastened with a pin just in front of the ear, and the bandage, being folded down over it, can be easily carried under the chin and over the vertex. In applying this last turn or two the roll of the bandage is necessarily reversed, as shown in the illustration.

When dressings are to be kept on the top of the head, some of the turns under the jaw should be made first, so that they are kept in place by the circular ones ; or, where it is desirable to avoid the unsightly appearance of a bandage under the chin, the circular portion should be applied and fastened with a pin at the forehead ; a turn can then be taken over the head and be pinned again at the occiput, and so backwards and forwards two or three times.

When it is advisable to apply pressure to the side of the head (wound of temporal artery &c.), the following modification of the circular bandage will be advantageous :—After a couple of simple turns round the forehead and occiput, the bandage is to be made to ascend and descend alternately as it passes over the point where pressure is to be applied. The arrangement is seen in fig. 104, and closely resembles the

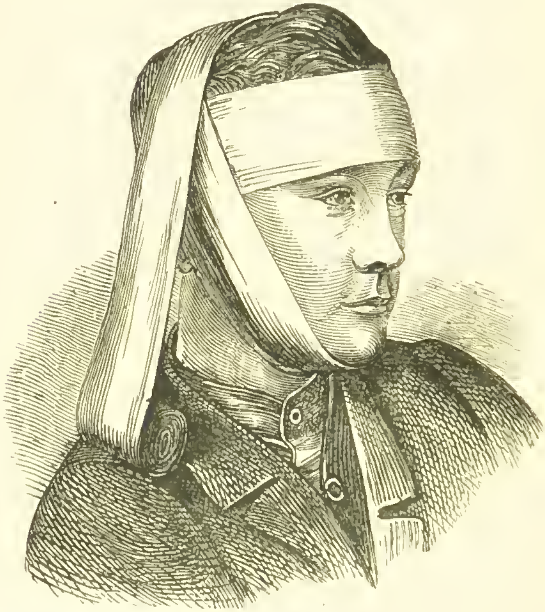

Fig. 103.

appearance produced by making reversed turns, none of which are, however, made, the bandage being kept flat to the head throughout.

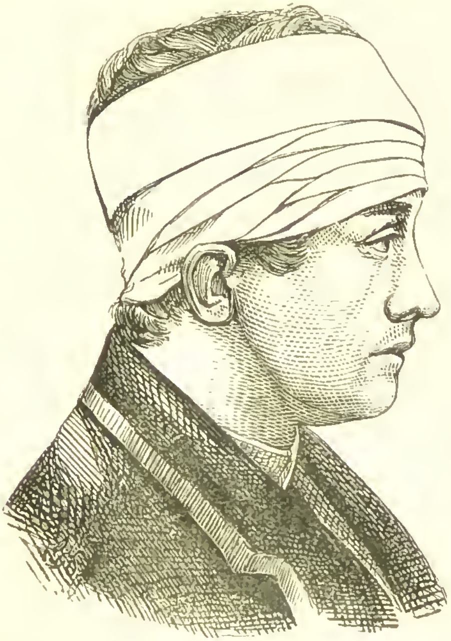

FIG. 104.

The *halter bandage*, which is a revival of Barton's bandage for fracture of the lower jaw, is useful for keeping dressings on the head and face. Beginning at the top of the head, the bandage passes beneath the chin and up to the vertex, where it crosses and is continued below the occiput. Then coming forward horizontally it encloses the chin and again reaches the occiput, being brought up to the top of the head and again beneath the chin, as shown in fig. 105.

Recurrent bandage of the head: capeline.—This bandage is an exceedingly useful one for keeping dressings upon the head, or for making pressure upon the integument after extensive scalp-wounds. It has the disadvantages of being a little difficult to apply, and of being rather hot.

A double-headed roller, two inches wide, is required, one head being a third larger than the other. The patient being seated, the operator stands behind him, and, taking the small roll in the right and the other in the left hand, applies the intermediate portion of the bandage upon the patient's forehead. It is essential that the commencement of this bandage should be as low on the brow as possible, and the rolls are then brought round the side of the head to

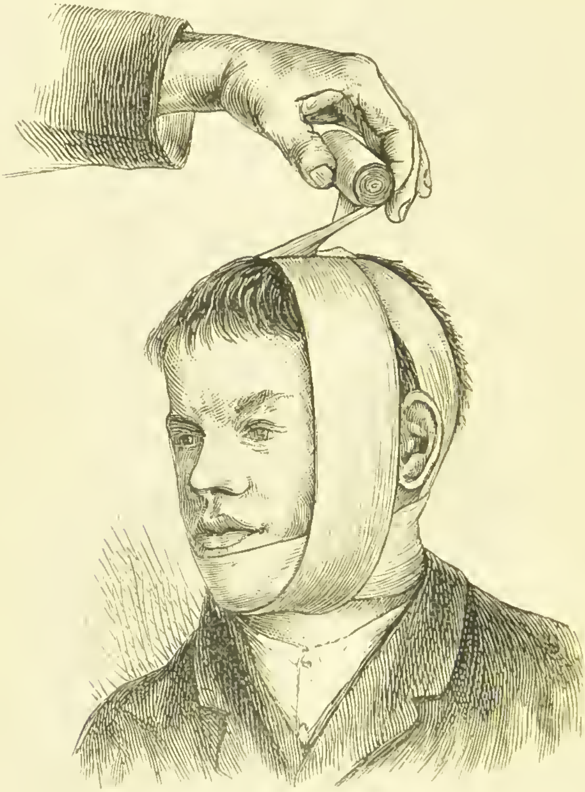

FIG. 105.

as low on the occiput as convenient, for this will vary somewhat with the shape of the individual's head. The bandage in the operator's left hand is now to cross the other, and to be transferred to the right hand, while the other bandage is to be folded over it and carried along the middle line of the head with the operator's left hand.

The bandage now in the right hand continues its horizontal course around the head to the forehead, where it again crosses the other bandage and passes round to the occiput. The vertical bandage is folded back over the horizontal (which keeps it in position), and passes a little to the *left* side of the middle line to the occiput. It is then crossed again by the horizontal bandage, and passes forward to the *right* side of the middle line, and, being again crossed by the

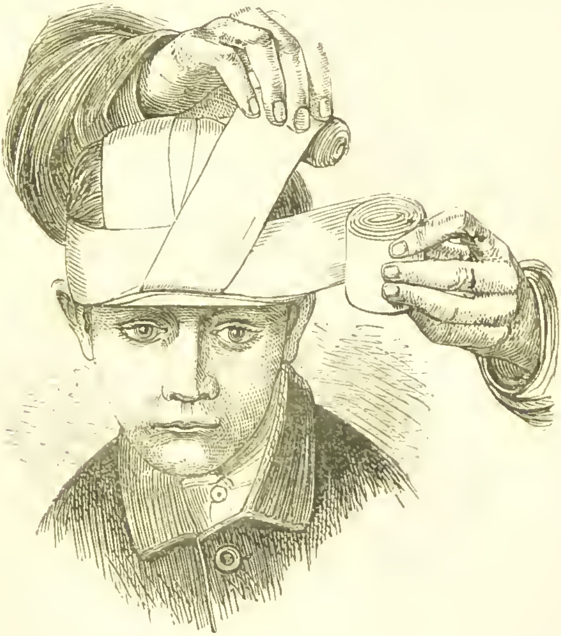

Fig. 106.

horizontal, passes to the occiput on the left, overlapping the former fold in the same direction. This is the point in the application shown in the illustration (fig. 106), and the hands, having just exchanged bandages, are seen passing, the one in a horizontal, and the other in a nearly vertical direction. These turns, from before backwards and in the contrary direction, are regularly continued until the whole head is covered, when the horizontal bandage is to make a few extra rounds, so as to keep all tight. The result is seen in fig. 107, where the end of the vertical bandage has been left hanging out to show how it is finally secured by the horizontal turns. It will be observed that all the folds from forehead to occiput are on the left of the middle line, while those in the contrary direction are on the right. Great care should be taken to keep the horizontal bandage low down on the brow, and to place the crossings of the bandages as near to the middle line as practicable.

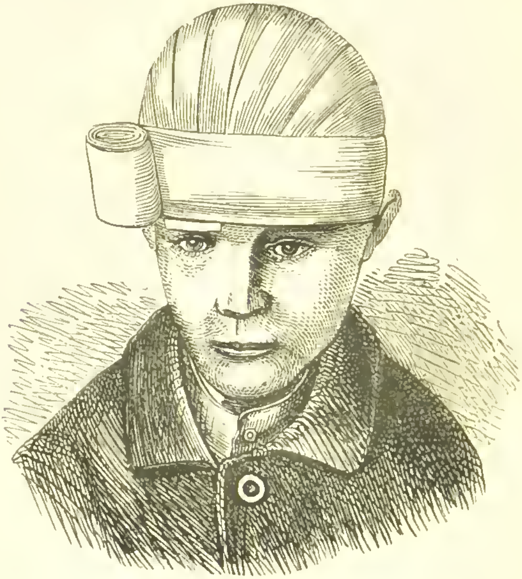

FIG. 107.

To bandage a stump.—The object of this bandage is not only to confine the necessary dressings, but, in addition, to support the flaps, and counteract the tendency of the muscles to drag away from the cut extremity of the bone. In order to accomplish these objects, the bandage should be begun at some distance from the end of the stump, and be carried round it with moderate tightness from above downwards for a few turns; the right hand then holding the roller beneath the limb, the left is to grasp the part, so as to fix the bandage with the tips of the fingers at that point.

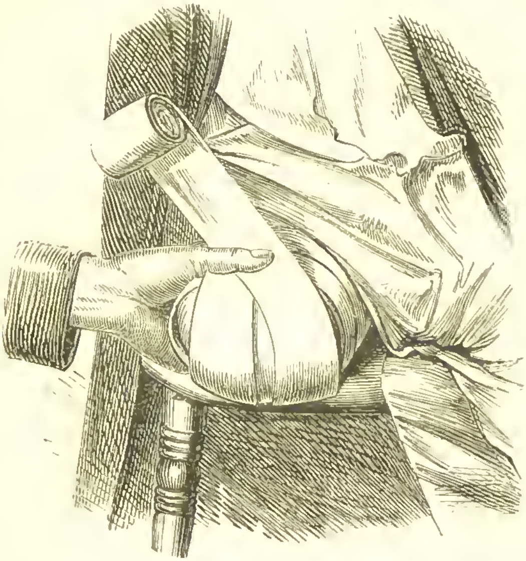

Fig. 108.

The roller can now be brought up over the face of the stump, and be fixed in front with the thumb (fig. 108), to be taken back again a little to one side of the first fold, and again secured with the fingers; and this can be repeated until the stump is sufficiently covered, a few circular turns being made at the last to secure the folds in their proper places; or, if preferred, a circular turn may be made after each fold across the stump, so as to secure it at once and set the left hand more at liberty.

The T *bandage* is a useful apparatus for keeping dressings on the perinæum or anus. It is formed of one piece of bandage, to go round the waist and fasten by tying or with a button, to the centre of which another piece is attached, to pass between the thighs and be fastened to the circular portion in front. This vertical portion may be conveniently split towards the end so as to pass on each side of the scrotum, and may be used to keep dressings upon the groins, if the ends are made to diverge well in front.

An extemporaneous T bandage may be formed from an ordinary roller by fastening it around the waist with a knot in front, then carrying the end between the thighs and on one side of the genitals, looping it over the circular bandage behind, and bringing it forward again on the other side of the genitals, to fasten in front. This is the form ordinarily applied after an operation for *fistula in ano* &c., but is then generally commenced behind. A very convenient plan in the case of operations about the female genitals is, by means of a tape round the waist, to fasten an ordinary diaper behind, which, being kept out of the way during the operation, can be drawn down and secured with a pin to the tape in front at its conclusion.

Suspensory bandage.—The ordinary woven suspensory bandage of the instrument-makers is convenient enough when the testicle is not enlarged, but if it is, the scrotum may be more conveniently supported with a handkerchief. This should be folded into a triangle, and the straight side or base being passed beneath the scrotum, its ends are to be attached to a piece of bandage going round the waist. The apex of the triangle is then brought up in front and fastened to the bandage at the required height.

Support for the scrotum may be gained by adding to a T bandage a piece of calico, sewn at right angles immediately behind the point to which the bandage is split to allow of the passage of the penis. This passes beneath the scrotum and supports the testicles, being attached on each side to the waistband.

When the patient is confined to bed, efficient support for the testes can be obtained by placing a small cushion between the thighs, or by fixing a broad strap of plaster across both thighs, upon which the scrotum may rest.

Many-tailed bandage.—This may be formed in two ways: either by taking a piece of calico or muslin the length of the limb, and wide enough to go at least once and a half round it, and then tearing it transversely from each side in strips, two inches wide, to within a couple of inches of the middle; or by making a number of strips of equal length of ordinary bandage, and then attaching them along another central piece at right angles, with a needle and thread. In either case the central portion is to be applied to the back of the limb, and the transverse pieces folded over it in regular order, beginning from below. In stitching the transverse strips to the central portion, the upper strip should be attached first, and the next made to overlap it slightly, and so on to the end, so that when folded over from below upwards each turn may overlap slightly the one below it, and thus give additional support. This is an advantage which the bandage does not possess when made from a single piece of calico.

The many-tailed bandage is applied to limbs which require constant dressing, but which it is desirable should not be moved, as they would of necessity be for the application of the ordinary roller.

Handkerchiefs may be usefully employed in some cases, either as temporary or permanent supports.

The use of handkerchiefs in British surgery is not, however, of sufficient extent to require a detailed account of the various methods of application, which will be sufficiently appreciated by referring to the descriptions of the corresponding forms of bandages.

Slings for the arm or hand may be most conveniently formed of a handkerchief folded into a triangle, or of a triangle of any suitable material. A sling for the *hand* (fig. 109), where the object is to support and raise the part, is best made by folding the triangle into a broad cravat, which can then be knotted round the neck so as to give the required height to the hand. In applying this, the end of the sling passing in front of the hand should always go over the *opposite* shoulder, to meet its fellow at the back of the neck. The reverse method of proceeding does not give nearly so efficient a support to the hand, which is apt to slip out.

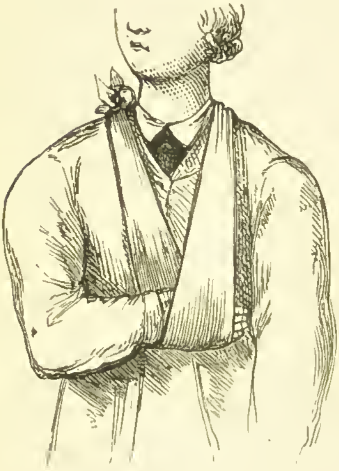

Fig. 109.

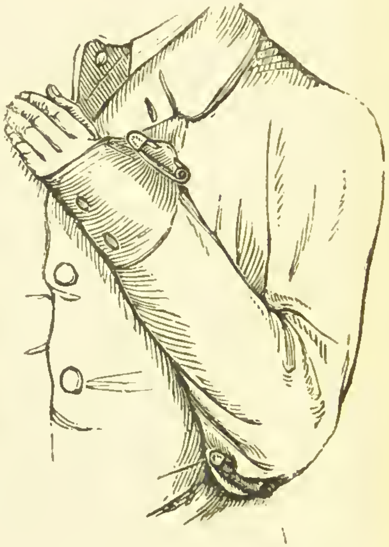

Fig. 110.

Mr. Gamgee invented a 'pin sling' (fig. 110), by which the hand can be conveniently raised to any required height by attaching the cuff to the coat with a strong safety-pin. A second pin attaches a fold of the sleeve to the coat just under the elbow, and a third pin, fixing the inside of the arm-sleeve to the body of the coat, is advantageous.

A sling for the *arm* (fig. 111) is best formed by placing the base of the triangular handkerchief beneath the wrist, and taking the end of the sling which passes in front over the shoulder of the affected side, to meet its fellow at the back of the neck. The apex of the triangle may either be folded in or brought round the arm and pinned in front.

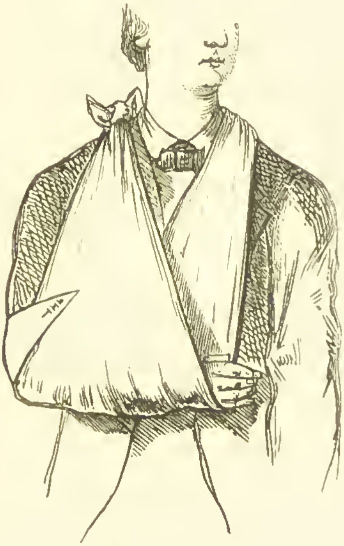

Fig. 111.

In using any sling made from a handkerchief, the wearying drag round the neck and uncomfortable pressure of the knot may be entirely obviated, by attaching the ends of the handkerchief to the coat or dress at the back of the shoulders, by means of a couple of safety-pins.

The arm-sling made of leather or perforated zinc, with a padded strap (fig. 112), is a most comfortable support if properly put on—viz. with the strap going through the axilla of the affected side, across the back, and over the opposite shoulder. In order to accomplish this, one of the straps must be unbuckled and replaced on each occasion of putting on or taking off the sling. It is usually simply put on round the neck, where its drag is most irksome.

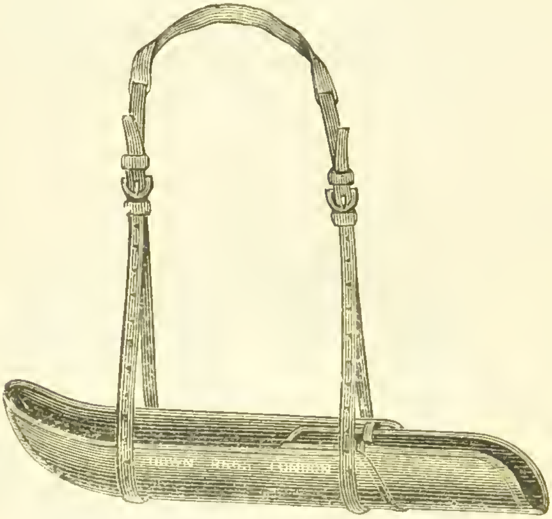

Fig. 112.

To tie in a catheter.—Various modes of performing this operation are practised. In all cases, if a silver catheter is used, the tapes will be made fast to the rings at the end of the instrument; but if an elastic catheter is preferred, the tapes must be fastened securely to it by means of a clove-hitch, the nature of which is described in the chapter on Dislocations.

1st method.—A piece of narrow tape about twelve inches long is passed through both rings of the catheter, and the ends are brought down the opposite sides of the penis. The foreskin is then drawn well forward, and a piece of strapping half an inch wide is carried circularly three or four times round the body of the penis immediately behind the glans, enclosing within it the ends of the tape. This method is very effectual provided the skin has been drawn well forward, for otherwise the catheter has too much *play.* The strapping round the penis does not produce chordee, as might have been feared, since the plaster only adheres to the skin without materially compressing the organ itself.

This method may be modified by using ligature thread or silk instead of tape, knotting the two threads together about two inches down, and tying them behind the *corona glandis* beneath the foreskin, the knot lying by the side of the frænum.

2nd method.—A tape is passed through the rings as in the former case, but a greater length is necessary. The ends are to be brought on each side of the scrotum and between the thighs to the loins, where they are to be knotted together and then fastened round the waist.

This method holds a metal instrument very securely in the bladder, since it is impossible it can come out while the tapes are properly tightened ; but it is unsuitable for cases where there is a tendency to chordee, or with a soft instrument.

3rd method.—A piece of bandage a yard and a half long is split at each end for one-third of its length. Two of the tails are fastened round the waist, and the other two carried along the groins and between the thighs, to be fastened to the waist bandage behind. The tapes or threads attached to the catheter can now be readily fastened to the bandage close to the root of the penis, a hole being cut in the bandage for the purpose if desired.

4th method.—For this an ivory or gutta-percha ring, large enough to go easily over the penis, is necessary. As this method is a little complicated, it is well to avoid its repetition every time the catheter is changed, by tying separate pieces of tape to the rings of the instrument, so that it can be freed without removing the whole bandage. The tapes are brought down on each side of the penis, and are *knotted* to the ring around the root of the organ, the length of the tapes being accurately adjusted so as to hold the catheter in its proper position; the tapes are then carried round underneath the thighs and encircle them, a knot being formed in the centre of the groin on each side. The ends are next carried round the loins, and, having been crossed, are finally tied near the umbilicus (fig. 113). Care must be taken that the ring is amply large, and that the portions of tape on each side of the penis are maintained sufficiently short.

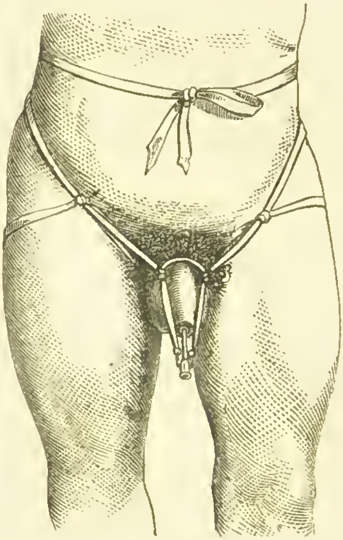

Fig. 113.

5th method.—The following plan has been devised by Sir Henry Thompson, and answers well (fig. 114). The middle of a piece of 'bobbin thread' (which cuts much less than ordinary ligature) is tied on to an elastic catheter, and the double thread carried halfway down the side of the penis, where it is knotted (A). The two threads then encircle the organ loosely, and are again knotted on the opposite side (B). A bundle of pubic hairs having been selected, the threads are adjusted to the proper length, and are then tied around the bundle of hairs (C). A similar thread is then tied on the opposite side of the catheter, and the proceeding repeated, each pair of threads encircling the penis, and being tied to the pubic hair on the side opposite to that on which they hold the catheter.

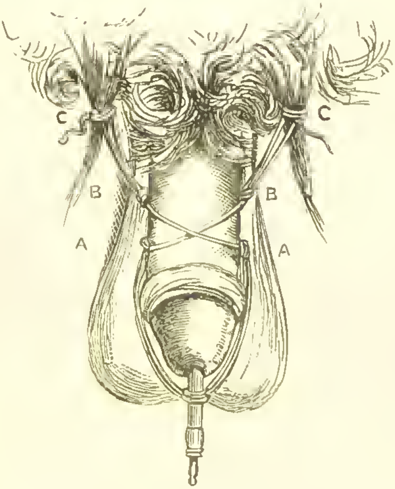

Fig. 114.

When a metallic instrument is used, the ordinary stilette will be sufficient to restrain the flow of urine; but when an elastic catheter is preferred, a little wooden spigot must be fitted to it. In cases of injury to the bladder &c., when it is desirable to carry off the urine as fast as it is secreted, an india-rubber tube may be conveniently fixed to the instrument and carried into a suitable urinal under the bed.

A catheter, when retained for any time, is apt to become clogged with mucus &c., and if it is undesirable that it should be removed at the moment, it may be readily cleared by passing a stream of water through it by means of the india-rubber bottle described in the section on 'Washing out the bladder' (p. 91).

To tie a patient for perineal lithotomy.—The bandage, usually of flannel, or soft broad worsted tape, should be about a yard and a half long when doubled, and the assistant who is going to tie should make a noose in it, by placing the centre of the double over his own wrist, then taking hold of the

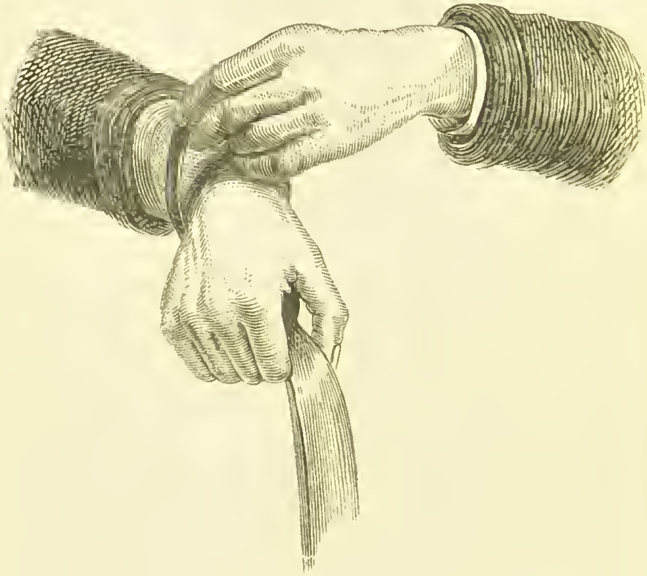

Fig. 115.

bandage lower down and drawing it through the loop on the back of his hand (fig. 115). The noose thus formed is to be fastened securely round the wrist of the patient on each side by a couple of assistants (fig. 116), and when the operating surgeon gives the signal (generally after the staff is introduced), another pair of assistants should bend the patient's knees and place his feet in the palms of his own hands. The first pair of assistants are then to bind the hands and feet firmly together, by forming a series of figure-of-eight turns round the ankle and wrist with the ends of the bandage, finishing off in front of the ankle-joint with a bow. The patient is then brought to the edge of the table, and an assistant on each side holds the knee steady by passing his arm over it and firmly grasping the foot, carefully maintaining the position the operator may indicate.

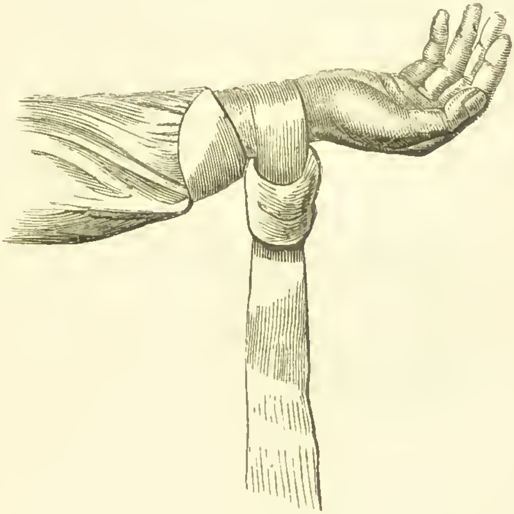

Fig. 116.

For all long perineal operations, especially the tedious ones performed on the female, some form of retentive apparatus is to be preferred to the tie, which is apt to become loosened and slip. Either laced gaiters may be employed, in which case the lacing goes across the sole and the ring is to the outer side, or a simple padded flat strap may be used; in either case to be hooked on to a stout wrist-band (fig. 117). Clover's crutch is a horizontal bar fitted with straps at each end for the knees, which may be employed for perineal operations on either sex.

Retractors are not nearly so often used as in former days, but the house-surgeon should know how to make one if desired. In amputations of limbs with a single bone a retractor of two tails is required, but where there are two bones, one with three tails will be necessary. A retractor is made of a piece of calico of a width suitable to the size of the limb, and about three feet in length. One end should be split and torn up to the centre of the retractor, where a small circle may be cut out with the view of accommodating the bone better. The three-tailed retractor is made in the same way, but is split into three parts, the middle one being intended to pass between the bones.

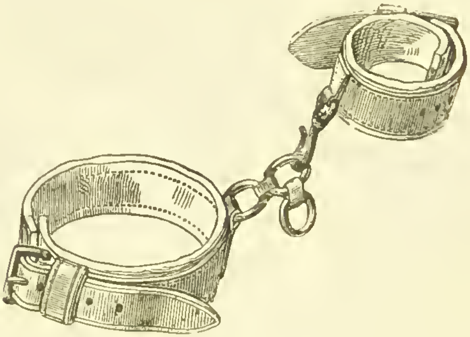

Fig. 117.

CHAPTER IX

FRACTURES

The entire subject of fractures is much too wide to be treated of systematically in a handbook like the present, and it is to be supposed that a house-surgeon, besides having a general knowledge of the subject from previous reading, will possess some larger work on surgery to which he may refer for any minute point of diagnosis. In the following pages, therefore, reference will be made only to such details of the treatment of the ordinary features as may be useful to the house-surgeon, leaving him to refer to the works of Erichsen, Bryant, and Pick, or to the elaborate American work by Dr. Hamilton, for further information, and for varieties of treatment other than those in common use in English hospitals.

Diagnosis.—In the majority of cases there can be no doubt as to the nature of the accident on its first admission. The distortion of the limb, and the inability of the patient to perform the ordinary movements, will sufficiently mark the nature of the case, which will be further confirmed by the sensation of crepitus imparted to the hand placed over the seat of injury while the limb is gently moved. When it is perfectly obvious that the bone is broken, it is only cruelty to twist and turn the limb about merely for the sake of producing crepitus, and thereby injury is often done to the soft parts, and the amount of extravasation is in all probability increased.

The errors into which the young surgeon may possibly fall are, first, mistaking a deformity resulting from an old injury for a recent fracture (particularly if the patient should not be able to answer questions from drunkenness &c.), and, secondly, mistaking the crepitus of a joint for that of a fracture. The latter is the more common error, and fortunately does little real harm. To guard against this, it will be necessary to notice whether the *entire* bone moves when rotated, or whether (as in fractures) the crepitus is produced in the length of the bone; careful measurement and comparison with the opposite side will show also that there is not the *slightest* difference in the length of the limbs, and the patient, if urged to do so, will probably be able to exercise an amount of force with it which would be incompatible with the existence of a fracture. Women, who have been hard at work all day at the wash-tub, not unfrequently find at night that a swelling has taken place at the lower part of the arm, which they attribute to some blow, and apply at a hospital for relief for a supposed fracture of the radius, which the swelling and obscure crepitation, the result of effusion (tenosynovitis), cause it to resemble pretty closely; and in the same way persons with rheumatic joints who may happen to meet with an accident exhibit an amount of crepitus, which might very possibly mislead the unwary surgeon. The house-surgeon need scarcely be warned not to concentrate his attention entirely upon the injury in one limb, to the neglect of fractures or other injuries in other parts of the body; but such cases of inattention have actually occurred.

Simple fractures.—In the examination of simple fractures the greatest care must be taken not to convert them into compound ones by rough manipulation, which might cause a spiculum of bone to perforate the skin; and in all cases, therefore, of supposed fracture, the limb should be thoroughly exposed by cutting open the clothes before it is manipulated in any way.

The time chosen for 'putting up' fractures varies a little in different hospitals, some surgeons applying splints &c. immediately, others preferring to wait until all swelling has subsided; but this only refers to fractures of the lower extremity, those of the arm being dressed at once and treated for the most part among the out-patients. If a fracture is quite recent, it will be found most convenient to put it up at once, since the subsequent swelling is thereby often entirely prevented; but should some hours have elapsed since the accident, and the limb be already swollen, it is impossible to put it up in its final apparatus, and it may therefore be laid on a pillow or loosely fastened upon a splint until the swelling has subsided. In all cases where the treatment has been immediate, the possible occurrence of subsequent swelling must be borne in mind, and the patient, if allowed to go home, should be strictly enjoined to come and show himself within twenty-four hours, or earlier if the limb become painful or numbed. In the hospital a little care will prevent any untoward results from tight bandaging &c., but it does occasionally happen that a limb will swell imperceptibly or while the patient is asleep, and produce an injurious amount of constriction, and the house-surgeon should therefore take a look at all recent fractures the last thing at night. Should the amount of swelling which has already taken place interfere with the diagnosis of the injury, it will be better to use palliative measures, such as cold lotions and a sling, until the swelling has gone down; and in obscure cases it will be only right to take the visiting surgeon's opinion before commencing a course of treatment.

Since in certain cases of obscure injury about the upper ends of the femur and humerus *impaction* is one of the best forms a fracture can take, it would be a very bad practice to undo by rough manipulations the natural cure thus effected, though by so doing the diagnosis might be rendered more complete.

Dislocations accompanying fractures of the shafts of bones should be reduced as soon as the limb has been firmly put up in splints, so that it may receive no further injury ; but in *fractures of or near the articular extremities with dislocation of the fragment*, as in the case of fracture of the upper end of the humerus with dislocation of the head, it will be necessary to manipulate under chloroform the head of the bone into its proper place before the fracture can be properly set. Or, if this is impossible, the shaft must be brought into close relation with the glenoid cavity so that a false joint may be formed, or the fracture must be allowed to unite without reduction of the dislocation. Occasionally it may be possible to reduce the dislocation after union of the fracture, but in the majority of instances the attempt leads to re-fracture of the bone.

In any case of this complicated injury it is advisable to explain to the patient and his friends exactly what has occurred, lest the non-reduction of the dislocation, which will become obvious enough when the swelling has gone down, should be attributed to carelessness.

The administration of an anæsthetic is often of the greatest service in cases of fracture, both by enabling accuracy of diagnosis to be obtained, and by assisting in the reduction of the broken fragments by completely relaxing the muscular spasm, and thus in many cases obviating the necessity for the division of tendons &c. The advantages of the use of an anæsthetic in case of fracture complicated by dislocation must be still more obvious.

Compound fractures should, if possible, be converted into simple cases as soon as may be, by healing the rent in the skin. When the injury to the integuments is recent and slight, a piece of lint soaked in collodion or the compound tincture of benzoin, a piece of iodoform wool, or an antiseptic dressing should be immediately applied; but when some time has elapsed since the accident, the wound should be completely cleansed and, if necessary, syringed out thoroughly with carbolic lotion (1-in-20) before the wound is closed. In more severe cases of laceration of the soft parts, after washing out thoroughly, iodoform should be blown into the recesses of the wound and a dressing of iodoform-wool be applied, unless recourse be had to a Listerian dressing from the first, as described at p. 179. In compound fractures it will be advisable to extract any loose fragments of bone at once, and it may be necessary to cut off one or more projecting angles before the bones can be brought into apposition.

The question of amputation in compound fractures must, of course, be left to the visiting-surgeon, and the house-surgeon should not hesitate to request his immediate attendance if any of the following complications be present:—1st, great comminution of the bones and destruction of soft tissues; 2nd, two or more compound fractures in the same limb; 3rd, rupture of or severe injury to the principal vessels and nerves of the limb; 4th, a compound fracture into a large joint.

Setting fractures.—All fractures, both simple and compound, must be set properly—*i.e.* the broken portions must be brought into their proper relation with the rest of the limb—before a cure can be effected. As a general rule, it is better not to attempt to set a fracture until everything is ready and at hand for its final treatment or 'putting up;' but when a piece of bone is seen to have taken up such a position that any slight movement of the patient may force it through the skin, it will be better to make traction at once, restore the piece, if possible, to its proper place, and keep up extension while the necessary apparatus is being prepared. In thus effecting extension, one assistant should grasp the limb firmly above the injury and another below it, and both should then make steady traction in opposite directions until reduction is effected, of which the house-surgeon will judge partly by the restoration of the symmetry of the limb, partly by carrying the finger along the most prominent portion of the bone to ascertain its regularity, as well as by comparison with the other limb and careful measurements.

Should it be found impossible to set a fracture properly, it may be advisable to give chloroform in order to thoroughly relax the muscles, or to divide a resisting tendon subcutaneously, *e.g.* the tendo Achillis. In any case of difficulty the visiting-surgeon's advice should be obtained at an early date, so that a fracture may not be left many hours unadjusted.

In making comparative measurements of limbs, great care must be exercised to take precisely the same fixed points on the two sides; and an ordinary measuring-tape is the best instrument for the purpose, since the exact measurement of each side can be at once read off and recorded.

The following are the principal points made use of in measuring the limbs :—

In the upper extremity—

From the acromial angle to the external condyle of the humerus.

From the tip of the coracoid process to the inner condyle.

From the condyles to the styloid processes of the radius and ulna.

In the lower extremity—

From the anterior superior spinous process of the ilium to the *lower* border of the patella. (The lower border of the patella should always be selected, and the bone be pushed up as far as the ligament will allow it to go, or error may be caused by the contraction of the muscles of the thigh.)

From the crest of the ilium to the top of the trochanter.

From the patella to the inner or outer malleolus.

From the anterior superior iliac spine to the malleoli.

A line (A B) drawn from the anterior superior iliac spine to the tuberosity of the ischium (fig. 118) will, in the healthy subject, just touch the top of the great trochanter. This is Nélaton's test line for dislocation of the femur upwards or backwards, in either of which accidents the trochanter will reach above the line. Mr. Bryant has called attention to the value of the ilio-femoral triangle (fig. 118) in the diagnosis of injuries about the hip, and particularly of impacted fracture of the neck of the femur. The patient being recumbent, a vertical line (A C) is allowed to fall from the anterior superior iliac spine, from which the distance (C D) to the top of the trochanter can be measured at a right angle to it. If the neck of the femur be broken and the trochanter drawn up, this line will necessarily be shorter than on the sound side.

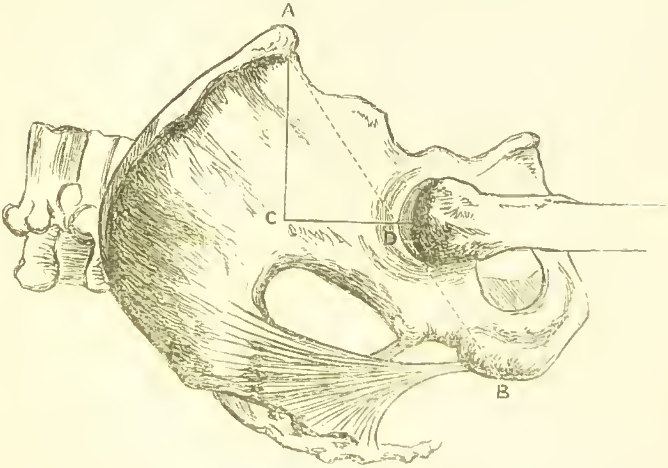

Fig. 118.

Before applying any apparatus, the limb should be cleansed with soap and water; and in hot weather a little starch-powder dusted over the skin will prevent the itching, which may otherwise become intolerable. Boracic powder rubbed into the skin under splints is inimical to fleas.

Apparatus for fractures.—*Splints* of every possible form have been invented for the treatment of fractures, the greater number of which are never used, at least in hospital practice. Both metal and wooden splints are in common use, and the ordinary ones will be indicated in the following pages in describing the treatment of the individual fractures. Both kinds must be carefully selected so as to fit the limb accurately, and should be thoroughly padded before being applied.

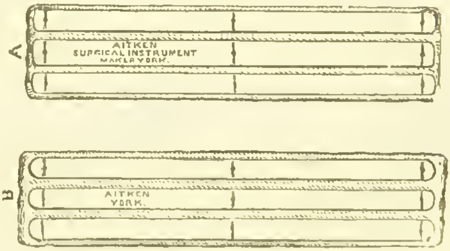

Fig. 119.

The practice of cutting splints from deal boarding is objectionable in the case of those for the upper extremity, since the convex limb is apt to be unduly crushed against the flat rigid surface of the splint, even when carefully padded. It is better to use the split wood commonly called Gooch's splinting, which may be cut of the necessary size and which yields to the limb; or to employ properly shaped wooden splints, which are made concave to fit it.

The Crimean splints made by Aitken of York (fig. 119), consisting of strips of wood or metal sewn upon well-made pads, are very convenient because always ready; the metal ones having the advantage that they can be bent if necessary.

Pads may be made of tow, cotton-wool, or sheep's wool, the advantage of the last being its greater elasticity. The material chosen should be carefully packed together, so as to fit the splint and slightly overlap its edges, and should then be enclosed in a piece of soft cloth or muslin, which may either be made to wrap round the splint and pad together, or, enclosing the pad alone, may be afterwards stitched to the splint, according to the fancy of the surgeon. Care must be taken to prevent the stuffing of the pads becoming lumpy and uncomfortable; and in making large pads which will be subject to continued pressure for some weeks, it will be advisable to have the thread carried through them at a few points, so as to prevent the shifting of the stuffing. A sheet of 'Gamgee tissue' forms admirable pads, and can be cut to fit any splint.

Very sufficient *extempore* pads may be made for the use of out-patients, by wrapping some tow or wool in a piece of muslin or lint, and then fastening it to the splint with a strap of plaster at each end.

Splint-room.—Every hospital is, or should be, provided with a room specially fitted to contain surgical appliances. It should be fitted with cupboards, having shelves long enough to hold full-sized splints, which should be kept sorted and padded ready for use. In order to keep the splints and pads clean, a sheet of unbleached calico should be folded round each division; otherwise the dust gets in, and, when required, the pads have to be re-covered.

All splints should be thoroughly washed before being re-padded; and if employed for gangrenous cases &c. they should be re-painted if made of iron, or scraped if of wood, before being again used.

Gutta-percha is a most useful material for splints, and for this purpose its thickness will vary from an eighth to a quarter of an inch, according to the amount of support required. To use this substance effectively one or two minor precautions are necessary; the first of which is that a pattern of the splint required should be made in brown paper, so that the gutta-percha may be cut an inch or two larger every way, since the gum undergoes contraction upon being immersed in hot water. A basin or pan sufficiently large to take in a piece of gutta-percha without bending should be provided, and *boiling* water will be necessary for its preparation. It will save scalding the fingers, and also maintain the shape of the splint better, if the gutta-percha be laid upon a piece of muslin of suitable size, by which it can be immersed in the water, and held there until perfectly softened. Being then lifted out by means of the muslin, it should be allowed to cool for a moment or two, so as not to scald the patient's skin, and must next be applied to the part to which it is intended the splint should be fitted. The wet fingers of the operator should then mould it carefully to the limb, and afterwards a bandage had better be applied so as to maintain it in position until cooled. In a quarter of an hour the splint may be removed, and any roughness of the edges trimmed off with a sharp knife, when it may be padded with wool or lined with wash-leather plaster, and will be fit for use. In order to obviate the unpleasant confinement of the perspiration which the gutta-percha causes, it will be advisable to make a series of holes in the splint, when perfectly cold, with a punch of the diameter of an eighth of an inch or more; and if the splint is lined with leather, it should also be perforated in the same way.

In fitting a gutta-percha splint to a case of fracture, care must be taken to bring the parts into the exact position they are intended to occupy eventually, before the gutta-percha cools, or the mould will be useless; and in some cases, therefore, it will be better to shape the splint upon the corresponding portion of the sound limb, and afterwards make any little alteration which may be necessary for the opposite side.

Leather.—Thick sole-leather may be used for making splints, being cut to a paper pattern with a sharp knife, and then softened in hot vinegar and water before being moulded to the limb, in the same way as the gutta-percha, over which it has the advantage of not interfering with the functions of the skin, but is otherwise not so manageable as the gum.

Leather is particularly useful in the treatment of chronic joint disease, especially of the hip, in children, in whom the application of a well-made leather splint, of the form shown in fig. 120, allows the use of crutches at an early period. In fitting a leather splint to the hip, or any other joint, it is most important that the leather should be thoroughly softened before it is

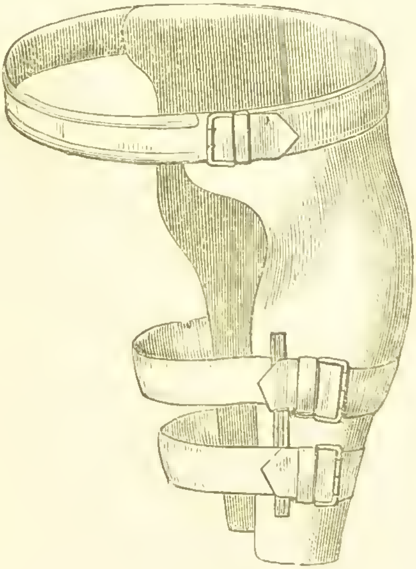

FIG. 120.

applied, so as to adapt itself easily to the irregular surfaces; and the splint should be made sufficiently large to take a firm hold of the pelvis and thigh respectively. When hardened by drying *in situ*, the splint should be lined with wash-leather, and fitted with straps and buckles, or, in the case of the smaller joints, the edges may be fitted with eyelet-holes, and a lace may be employed.

Poro-plastic splint.—This material, which is supplied in sheets of several qualities by Mr. Cocking of Plymouth, has the great advantage of only requiring to be dipped in boiling water before being moulded to the limb. It rapidly sets, and in the course of a few hours becomes dry and hard, when it may be removed and lined with wash-leather or linen before being re-applied to the affected part. When used for the treatment of fractures, a wooden splint may be advantageously applied as a temporary support during drying. The poro-plastic material is now supplied by the manufacturer moulded in all the sizes of ordinary splints, which can be slightly modified by the application of dry heat as required. It has also been extensively used for spinal supports, which will be found described at length at p. 279.

Immovable apparatus.—Under this head will be described the mode of applying bandages to which certain adhesive substances are added, with the view of fixing them firmly upon a limb, and encasing it so as to form a most useful method of treatment in almost every variety of fracture.

The substances in most common use among British surgeons are—1st, starch; 2nd, a mixture of chalk and gum; 3rd, plaster-of-Paris; 4th, glue; and 5th, silica. Of these the plaster-of-Paris bandage possesses, in the author's opinion, decided advantages.

Starch bandage.—The starch is mixed in the ordinary way with warm water, and is to be of the consistence of that used by laundresses. The limb being held in a suitable position by assistants, the old practice was to apply a dry bandage over its whole length. The starch is then to be painted with a brush over the bandage, and made to soak into its interstices ; and any inequalities are to be filled in with cotton-wool soaked in the starch. Strips of pasteboard, *torn* of a suitable size and shape, and well soaked in the starch, are then to be laid along the limb in the positions in which support will be principally required ; and, lastly, a well-starched bandage is to be applied two or three times over all.

Owing to the amount of moisture necessarily included in this apparatus, it will take many hours to dry, and the limb must therefore be carefully maintained in position by means of sand-bags, and, if necessary, by extension with a bandage. When the starched case is dry, it is customary to lay it open with a pair of strong cutting pliers, in order to see that the limb is in proper position, and another starched bandage is afterwards applied over the case to restore its continuity. If the limb should have been swollen when the bandage was first applied, in three or four days the starched case will be found to be too large, owing to the natural subsidence of the swelling; and it will be necessary to split open the case again, and, having pared the edges for the requisite amount, to re-apply it with a fresh external bandage.

The great difficulty in using this apparatus will be found to be the dangerous and unbearable constriction of the limb, caused by the shrinking of the first dry bandage. This, however, may be advantageously dispensed with altogether ; or, if employed, care should be taken to use a bandage which has been washed and thoroughly shrunk, and this precaution will be as well for all the bandages used with the starch. M. Seutin avoids the use of the first dry bandage by employing cotton-wool smeared with starch, in which the limb is wrapped, and this has the advantage of becoming compressed by the contracting bandages outside it, and thus guards the limb from injurious pressure. The house-surgeon must exercise the most vigilant care, for the first forty-eight hours after applying the starch-bandage, that no such pressure occur, and must not scruple to cut the whole apparatus away if the extremities of the limbs show the least symptom of it, or if the patient complains of feeling great constriction.

Chalk-and-gum bandage is applied in exactly the same way as the starch bandage. The adhesive mixture is made by adding boiling water to equal parts of gum arabic and precipitated chalk; and this material has the advantages over the starch both of becoming firm sooner and of having more strength, so that the addition of strips of pasteboard is rarely necessary.

Plaster-of-Paris bandage.—The plaster for this purpose should be the fine white powder used by modellers; and must not be old, or it will have become deteriorated by the absorption of moisture.

There are two ways of applying the bandage.

1st method.—Taking a loosely woven bandage (the crinoline muslin recommended by Sayre is admirably suited for the purpose), the dry powder is to be rubbed into its meshes on both sides with the palm of the hand, and the bandage is then to be loosely rolled. These powdered bandages may be kept rolled and always ready, if they are preserved in a covered jar so as to exclude the air. When required, the bandage should be placed on end in a basin of water, deep enough to cover it, for a couple of minutes that it may become thoroughly wetted, and should then be applied as rapidly as may be upon the fractured limb, which must be carefully held by the assistants. The bandage may be applied directly upon the skin if the fracture is an old one and has been treated in splints, so that there is no probability of swelling coming on; but in recent fractures, for which it is peculiarly adapted, it is necessary to envelop the limb in cotton-wadding, and even in old cases it is better to have a stocking over the limb, whether leg or arm. The best protection for the limb is the glazed wadding, and the limb should be thoroughly enveloped in one thickness of this, the glazed side being outwards. The advantage of this over cotton-wool is that it is not easily wetted and messed by the plaster. A turn or two of the plaster bandage may be taken over the limb to fix the wadding, and the limb is then to be systematically bandaged, and, as far as possible, 'reversed turns' should be avoided, but each fold of the bandage should thoroughly overlap the one below. It will materially strengthen the casing if the operator has a little of the plaster mixed with water to the consistence of cream by his side, and applies some of it with the palm of the hand between the two layers. If the interior of the bandage should not have been sufficiently wetted, it can be readily dipped into the basin again, and a little of the fluid plaster applied over all will fill up any irregularities.

2nd method.—If the powdered bandages are not already prepared, the following will be the readiest way of applying the bandage. Some cold water being placed in a basin, the plaster is to be shaken in, and the water well stirred until it becomes of the consistence of cream; then the bandage being placed in another basin of water, that it may become wetted as it unrolls, the operator is to commence rolling it *in* the basin containing the plaster, which will thus become effectually applied to its surfaces. The bandage should be applied to the limb in the manner described above, and some of the mixed plaster can be used to fill up the interstices. This method has the advantage, over that of rubbing in the dry plaster, that it remains firm when exposed to continued immersion in warm water.

When the surface to be covered with the plaster bandage is very extensive, it may be advisable to delay the setting of the plaster by the addition of a very small quantity of size to the water; or if that is not at hand, a little stale beer will answer as well. The addition of salt to the water increases the rapidity with which the plaster sets. A little bicarbonate of soda, added to the water in which the hands are washed after applying plaster-of-Paris, immediately removes the plaster from the fingers.

In whichever way the bandage is applied, the assistant who is holding the limb should maintain his hold for five minutes after the operation is completed, when the plaster will be sufficiently set, and will only require time to dry.

As far as possible the rule should be followed of fixing the joint above and below the fracture; thus, in the case of the thigh, the plaster bandage should be begun below the knee and be carried in a spica round the pelvis, so as to fix the hip-joint, especial care being taken to thoroughly protect the groin with wadding.

The day after the application of the bandage, when it has become dry, the surface should be painted with gum-water, white of egg, or, what is much cheaper, common flour-paste, which will prevent the plaster from chipping; and in children or imbeciles, when the bandage is likely to be wetted with urine, a coat of spirit-varnish over the exposed surface of the limb will prevent all damage, and materially assist in maintaining cleanliness. In cases of compound fracture or operation requiring to be dressed through a window cut in the plaster, the margins of the opening should be thoroughly soaked with the compound tincture of benzoin, which prevents crumbling away of the plaster when wetted. If a window be required, the situation should be indicated by some contrivance, and a good one is to take a piece of card of the requisite size, prick a pin through the centre of it, and place it, with the pin projecting outwards, over the required spot, and as the bandages are rolled over that part, to make the pin pass through them and project from the surface, as an indication of the centre of the area to be cut out from the plaster case.

Another (Dr. Esler's) method is to insert a chip ointment box, or other similar article, a little larger than the ulcer or wound, directly over the affected surface, and with a strip of bandage encircle the limb and box so that the ends of the bandages can overlap and be pinned over the box. When the plaster has hardened the pin is taken out of the piece of bandage which kept the box in position, and the ulcer is exposed ready for whatever dressing is required.

The great advantages which the plaster bandage possesses over the starch and gum are the ease with which it can be applied and the rapidity with which it sets, thus forming at once a perfect case for the limb, and obviating the necessity for the maintenance of extension during the process of drying. The plaster bandage is readily removed, when done with, by simply unwinding it; or should the plaster be too thick for this to be accomplished it may be sawn through with a convex saw; or the dilute hydrochloric acid may be rubbed along one side for a few minutes, when the bandage will become soft enough to be cut with scissors. In this way also valvular openings may be made if required.

Fig. 121 shows a revolving saw, contrived by Messrs. Down, for cutting through plaster-of-Paris bandages, but a fine saw with a convex edge answers every purpose, unless cutting pliers are preferred.

Wire and plaster-of-Paris splints.—A combination of plaster-of-Paris and telegraph wire forms a most satisfactory splint for the treatment of compound fractures and excised joints; in the manner about to be described, it has been extensively employed and found to be extremely efficient. The following description applies to a case of compound fracture of the humerus, in which the wound is about the middle of the outer side of the upper arm.

The bone being held in position, and the elbow flexed at a right angle, the wrist and forearm should be bandaged with a flannel roller, and over this two or three layers of plaster-of-Paris bandage applied; similar bandages should be applied to the arm above the fracture, and be carried well over the shoulder. Pieces of telegraph wire should be cut and bent so as to form three rectangular splints accurately adjusted to the limb—an inner one reaching from the axilla to the wrist, an anterior one reaching from the front of the shoulder to the wrist, and the posterior one passing from the top of the shoulder to the wrist. The fracture being properly reduced, the wire splints should be applied and fixed by a turn of strapping above and below it, and then immovably secured by three more layers of plaster-of-Paris bandage. The edges of the plaster case, which bound the interruption above and below, should be trimmed. The three

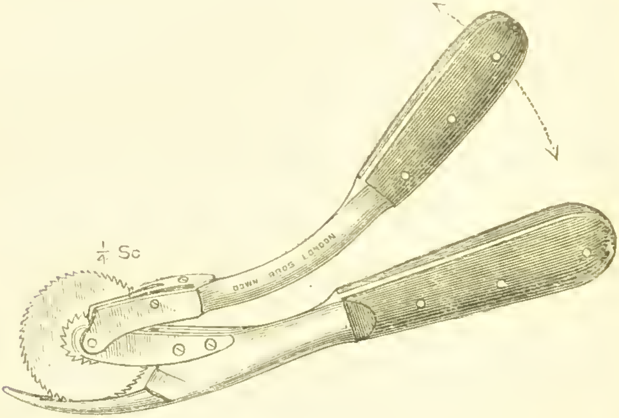

Fig. 121.

wires alone pass over the seat of the fracture, and they stand off from the limb sufficiently to allow of the deeper part of the dressing being applied beneath them.

But the apparatus, if used as described so far, is liable to the following accidents :—The blood-stained serum which oozes from the wound may trickle beneath the plaster-of-Paris case and decompose there, and the moisture produced in this way may sodden the bandages and weaken the splint. These objections are met by taking some melted bees-wax and paraffin (equal parts), soaking pieces of absorbent cotton-wool in it, and carefully packing them between the limb and the borders of the plaster apparatus, and then painting these and the borders of the plaster apparatus—above and below the interruption, over a width of three or four inches—with the melted wax and paraffin mixture. The completed apparatus forms an immovable support, which allows of the strictest antiseptic precautions in the treatment of the wound.

The method described above was suggested by that employed by Mr. Howse in cases of excision of the knee. He employs a mixture of yellow wax and olive oil in such proportions as render the wax just soft enough to be applied cold without cracking ; the mixture is warmed and bandages are passed through it, re-rolled, and allowed to cool. The limb is placed on the excision splint, and fixed by the waxed bandages : the intervals between the limb and the splint are next packed with pieces of absorbent wool soaked with the wax, and the whole apparatus is painted over with some of the hot wax mixture so as to weld the bandages together.

Bavarian plaster-of-Paris splints.—Take two pieces of flannel, long enough to reach from the ham to the ball of the toes, and a few inches wider than the circumference of the leg ; stitch them together along the middle line for the length of the leg, and beyond this cut them through in the same line; put the flannel behind the limb, with the seam exactly in the middle; bring the inner layer round and pin it along the front of the leg, the dorsum and sole of the foot, so as to form a tightly fitting stocking; smear this layer all over with plaster-of-Paris cream, and before it sets, press the outer layer, already cut to the proper size, evenly over it. When the plaster has set, remove the pins from the inner layer of flannel, and bring the borders of the latter round the edge of the splint in front and along the sole, and stitch it to the outer layer. The apparatus forms an accurately fitting splint, which can be easily removed without in any way disarranging the limb, as the seam along the back of it acts as a perfect hinge.

Croft's plaster-of-Paris splints, for the immediate treatment of fractures of the leg, consist essentially of two well-moulded lateral splints, made of coarse house-flannel, thoroughly soaked in plaster-of-Paris cream; the flannel should be thoroughly shrunk, and from it four pieces, having the shape of the patient's stocking, and long enough to reach from just above or just below the knee to the middle of the metatarsus, should be cut, particular care being taken that the foot-piece is at right angles to the leg-piece, and also that the anterior border of the latter is a straight line. Arrange the four pieces of flannel in pairs—two for each side of the leg—and saturate the outer piece of each with plaster a little thicker than cream, and re-apply it to its fellow. The splints being ready, the patient should be anæsthetised if necessary, the leg 'set,' and held in position with the foot at right angles to the leg, and the splints applied and fixed by a simple plaster-of-Paris bandage. The apparatus may be easily cut down the front, if need be, the edges trimmed, and the splint eased or tightened as required. If a window be needed, it should be cut in the flannel before it is soaked in the plaster-of-Paris cream.

Sayre's plaster-of-Paris jacket.—The method of treating both lateral and angular curvature of the spine by extension and the application of a plaster-of-Paris jacket, introduced by Dr. Sayre of New York, requires care to secure its efficiency.

The extension is made either from a tripod contrived for the purpose (fig. 122), or more simply from the top of a doorway, or any suitable beam into which the pulleys can be fixed with a screw. The cross-bar attached to the pulleys supports a leather strap fitted to the chin and head, and axillary straps, which may be employed if necessary. For lateral curvature the head strap only should be employed, and the patient should be shown how to suspend himself, with the toes touching the ground, while the bandage is applied. In angular curvature the extension, if any, should be carefully regulated so as to relieve and not cause pain. The following is in Dr. Sayre's own words (*British Medical Journal*, September 27, 1879) :—

'The first requisite is an elastic woollen shirt, knitted and without seams, similar to a stocking, with tapes at the top to tie over the shoulders instead of sleeves, as the shirt can then be pulled tightly down, and secured by a safety-pin between the limbs ; and thus, by its elasticity, be made to fit accurately all the inequalities of the trunk. Previously to its being thus secured, a pad of cotton, folded in a napkin, should be placed under the shirt over the region of the stomach ; and in females it should also cover the mammæ. After the plaster has "set" the pad is to be removed, and thus allow room for the stomach to expand after meals, and also to prevent any undue pressure on the mammary glands. The bandages should be made of coarsely woven muslin called "crinoline," so that the plaster can be rubbed into its meshes. They should be from three to four inches wide, and about three to four yards long. The gypsum should be pure, and freshly ground, and perfectly

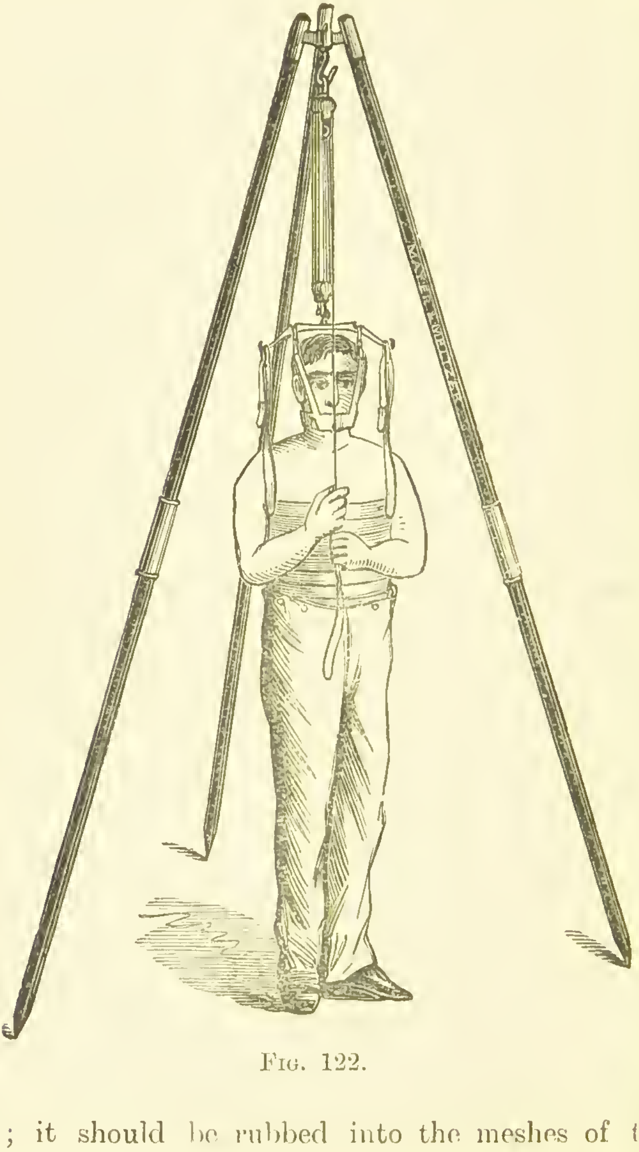

Fig. 122.

dry ; it should be rubbed into the meshes of the cloth, and then rolled, but not too tightly. As thus prepared, the bandages can be kept in an air-tight vessel, ready for use at any moment. If the climate be very wet, it is as well to subject them to the heat of an oven for a few minutes before using, to evaporate any moisture the plaster may have absorbed.

'When about to apply the dressing, the surgeon takes a single roll of the bandage, and drops it into a vessel of cold water, which should be deep enough to completely immerse it in the vertical position, and as soon as the gas has all escaped it is ready for use. As he removes it from the water he squeezes out the surplus water and drops into the basin another roll—end up—and by the time the first one is applied the next will be ready for use. This is to be continued until as many are applied as each particular case may require, the jacket being strengthened by slips of tin placed between the layers of bandage.

'In cases of spondylitis, the patient is to be carefully extended by the head and axillary straps until he is perfectly comfortable, and never beyond that point.

'As soon as the patient has been extended until he is perfectly comfortable, apply the wetted roller bandage smoothly over the skin-fitting shirt, not drawing it tightly, but simply unrolling it around the body, while an assistant follows with his hand and fingers and presses it into all the inequalities and irregularities of the body, thus obtaining an accurate mould of the trunk in the improved position which extension has given to it; and, by keeping the patient in this position for a few minutes until the plaster has set, he will then be retained exactly in the same position so long as the plaster remains unbroken.

'After the plaster has set, the pad which has been placed over the stomach and mammæ is to be removed. Slight pressure should be made over the lower part of the abdomen on the crista ilii before the plaster has hardened, so as to mould it to the form, and remove the undue pressure on the spinous processes and the crest of the ilium. As soon as the plaster has set, the patient (unless paralysed) can go out-of-doors and take the ordinary exercise so necessary for health, and, if an adult, can resume some active employment by which he can earn his support.

'When the deformity is in the neck, it may be necessary to affix a "jury-mast" to the back of the jacket in the process of making it, from which a strap passes beneath the chin to support the head and make slight constant extension upon the cervical vertebræ.

'The advantages claimed for this plan of treatment are :—

'1. Its applicability in all cases where any mechanical treatment can be applied, and by any surgeon in the country, without the aid of an instrument-maker.

'2. That, being accurately adjusted to all parts of the body when in its improved position, it gives more uniformity of support than can be done by any other means, and without making any undue pressure at any prominent point, and thus avoids all danger from sloughing and excoriations.

'3. By absolutely immobilising the spine, and removing undue pressure from the inflamed portion of the vertebræ, it affords greater facilities for ankylosis than can be given by any movable apparatus.

'4. The patients thus treated are capable of daily exercise in the open air, so necessary for health, and also of earning their support by manual labour.

'5. By applying this treatment in the early stages of the disease, before deformity has occurred, the patients will be cured (when curable) without any deformity.'

Poro-plastic jacket.—The use of the plaster-of-Paris jacket being found inconvenient on account of the difficulty of changing it sufficiently often for purposes of cleanliness, many surgeons have employed jackets made of Cocking's poro-plastic material, or a similar material perforated with holes, supplied by Hides. The following description of the method of applying a poro-plastic jacket is by Mr. Paul Swain, F.R.C.S., of Plymouth (*Lancet*, June 26, 1880):—

'As a preliminary, the following measurements are required: The circumferences at the axilla, the waist, and the pelvis, and from the axilla to the great trochanter. In addition to these measurements, accurate notes should be taken of the position of the curve, especially if it be angular; also of the various bony prominences, such as the anterior spines of the ilium. The process admits of any portion of the jacket being left soft, so that these prominent points may not be pressed upon. The upper and lower border is also better left soft, and in the case of females the area over the breasts. The felt formerly used was, I think, of too slight a texture, and failed to give sufficient support, or to wear well for any length of time. Now we are using a much thicker felt with considerable advantage. The jacket next undergoes the process of stiffening, and is then ready to be applied as follows:—

'The patient is stripped to below the pelvis, the dress in the case of a female being pinned round just above the pubes. A couple of very thick elastic jerseys are then placed on the trunk, fitting tightly to the form without creasing. It is needful to put on two jerseys, as the heat of the jacket when first applied is considerable. The patient is then suspended by means of the tripod and pulleys, made familiar to us by Professor Sayre. The amount of suspension will of course vary according to the requirements of the case. Whilst these preliminaries are being arranged, the jacket has been placed in a portable steam-bath heated by gas, conveyed by an india-rubber tube from any neighbouring gas-jet. If there is no gas in the house the kitchen oven will serve the purpose, only the jacket must be well sprinkled with water before it is put in. It requires about three minutes to make the jacket perfectly soft, but it wants some little experience to know the exact moment at which it is fit for application. It is then removed from the bath, and placed as rapidly as possible on the patient. To fit the jacket well certainly requires the aid of two persons. The surgeon should take charge of the back, as the moulding to that part is the most important, whilst his assistant proceeds as quickly as he can to buckle the straps in front. A small hint here may be useful to novices. The buckles are very hot on first emerging from the bath, and unless your fingers are well provided with cuticle a pair of gloves will add much to your comfort. The middle buckle, which will be found generally to tighten the jacket round the waist, is the first and most important one to secure. I take it that the grip of the jacket round the waist, especially on the female figure, is one of the most important points to be attained. The jacket must be made to fit well in that region, and thence to glide without a crease down over the brim of the pelvis. The pelvic buckles should be next closed, and lastly the thoracic ones. During all this time the surgeon is moulding the jacket to the form posteriorly.

'I have found that the best way to accomplish this is to encircle the patient with an arm, placing the hand in front as an opposing force, whilst with the other hand you knead the jacket into the figure, using principally the ball of the thumb. Thus the felt is pressed well into all the concavities. I have found that a slight knock on the jacket with the knuckle tells me if it is "well home." If there is any interspace between the jacket and the skin, a hollow sound is produced on percussion. If, on the other hand, the knock elicits a dull note, you may be sure of a good fit at that spot. The jacket very rapidly becomes hard and *apparently* inflexible. I say apparently, for as a matter of fact the steam-softened jacket remains pliant for some time. This is at once an advantage and a warning. The advantage is that you are able deliberately to complete your fitting for some time, pressing in here and turning out an edge there. The warning is that you must keep your patient perfectly still for half an hour after the jacket is fitted, or you will be disgusted to find that it has given way at some important point, and finally hardened into a thing of wheals and creases.

'If the patient is tolerant of suspension, the longer he is kept up in reason the better, else he must be let down and placed on a mattress prepared for him on the floor. It is very desirable that the jacket should not be removed for some days. In fact, I have had patients who have worn them continuously for a month without inconvenience.

'The after-treatment of these cases is of great importance, and the idea that when once a jacket is fitted you have done with the case must lead, and, I expect, often has led, to disappointment. This is more particularly the case in lateral curvatures. In such cases the jacket is, after all, I was almost going to say, subsidiary to other means of treatment. But herein is the special advantage of this method of spinal support, that its use does not preclude the further use of other curative methods. I allude especially to extension by suspension and gymnastic exercises. This necessitates the almost daily removal of the jacket. There is a right and a wrong way of taking off the jacket. The right way is, after the buckles have been undone, to slip the jacket round and remove it laterally. The wrong way is to stretch it open wide enough to remove it from before backwards, by which proceeding the back is soon split. When the jacket is off, the patient may use the prescribed exercises, and, finally, must be suspended for a longer or shorter time. The apparatus for suspension can be provided with the jacket, and need not include the tripod. The pulleys may be attached to a beam or to a hook screwed in over a door. But this rule must be invariably observed—viz. the jacket must be reapplied during the suspension of the patient. As in removing it, so in replacing it, it must be slipped on laterally.

'During the early months of treatment the jacket should be worn at night as well as by day. Now there is another point to be attended to—much overlooked, I think. If the treatment of the case is producing favourable results, one of the principal effects is a straightened spine. It is manifest that an alteration in the shape of the spinal column necessitates an alteration in the support, if it is to be any longer a support. To effect this the jacket must be again placed in the steam-bath and remoulded. And this will most likely be required very soon, and sometimes very often.'

Hammock-suspension and plaster.—Mr. Richard Davy has proposed (*British Medical Journal*, June 26, 1880) to obviate some of the inconveniences and possible dangers of Sayre's method of suspension by slinging the patient horizontally in a hammock as follows :—

A piece of strong canvas is procured, longer than the patient's height; and the arms are passed through two slits in the canvas at suitable points, so that, in the first instance, a loose canvas long apron, with ends, one turned downwards over the chest and the other on the floor, fits around the front and sides of the body. This apron is then removed from the patient, and a vest applied, of thicker material and far more open mesh than those usually supplied by the surgical-instrument makers. The canvas hammock is next slung at two fixed points, by attaching its two folded ends with two stout bandages ; and the surgeon should test its bearing-power by the weight of his own body. The patient is placed in the canvas face downwards, and an aperture in the hammock is made over the patient's lips, to permit free breathing and conversation. The patient is then finally localised in position, according to the variety of spinal curvature (extension by the head, arms, and legs being applied by those surgeons who deem it to be necessary), and the surgeon leisurely applies the plaster-of-Paris or other fixing material, including the canvas, which, of course, has been accurately cut to fit the dorsal contour. The free current of air around the patient's body, and, if the surgeon please, the hammock's suspension near to a fire, facilitate the regular and simultaneously complete drying of the plaster ; and so very comfortable are young children in these hammocks, that they either enjoy the swinging motion, or not unfrequently fall asleep. When the bandage has firmly set (and not before, for the patient can remain swung for any reasonable space of time) the whole hammock and patient are taken down, and the superfluous ends are neatly cut off with scissors, the canvas remnant acting as an accessory vest to the patient's frame.

Glue bandage.—Mr. C. de Morgan adopted the use of this bandage in the Middlesex Hospital, and thus described it :—The best French glue should be used. It should be broken up and soaked in a little cold water for some hours, and then melted in the usual way in a glue-pot, as little water being used as possible. It is not necessary to soak the glue in cold water, but if this is not done it will require the longer heating. When it is to be used, about a fifth part of its bulk of alcohol must be added—methylated spirit answers quite as well. At first this converts a great part of the melted glue into a whitish coagulum, but by a little stirring it all liquefies and is then fit for use. The alcohol is added to induce the rapid drying of the glue, which would otherwise remain soft for many hours, but when mixed with the spirit begins to get firm on the surface very soon after it is applied, and in a short time becomes tolerably firm throughout. It should be applied with a moderate-sized flat hog's bristle brush. Supposing that a simple fracture of the leg is to be treated, these are the steps to be taken :—

The foot should be neatly and firmly bandaged from the toes to the ankle. Two or three streaks of glue along the sides and front will secure the bandage, so that it need not be again disturbed. The leg from the ankle to the knee should then be covered with a very thin layer of cotton-wool—not the medicated wool, as it is called, but such as is procured in sheets for lining dresses. Of this a layer, not more than the eighth of an inch in thickness, can be easily stripped off and smoothly applied to the leg. A cotton bandage should then be rolled very smoothly and with tolerable firmness up the leg from the ankle to the knee, and well painted over with the glue. Another bandage should then be placed over the first, and the glueing process repeated. A third may then be applied and glued, and then a bandage should be put on over all, and the leg placed in position, and retained, if necessary, by sand-bags or junks. Of course, if the surgeon please, he may apply strips of bandage, or of any linen or cotton material he may find at hand, instead of repeating the rolling process. The glue should be laid on freely, and brushed a little into the bandage. In some cases two layers of the glued bandage will be found sufficient. In others it may be desirable to give greater support; but this can always be done as an after-process. The leg should be left at rest for from twelve to twenty-four hours. The glued bandage must then be cut through its whole length. This may be done with the ordinary scissors used for the starch bandage, or a director may be insinuated beneath the bandage and cut upon with a sharp knife. If too long a time elapse before the bandage is cut through, it becomes so hard that great difficulty may be found in cutting it at all. When the bandage is thus slit up, so great is its elasticity that it may have its edges separated sufficiently to allow it to be easily slipped off the leg ; and when left to itself it will resume its original shape, and this elasticity it will retain for as long as it is used. A strip not more than a quarter of an inch wide, and running the whole length of the bandage, should now be cut off from one edge, and holes punched out parallel to the edges on either side, and about half an inch from them ; into these 'eyelets' are to be inserted, such as are commonly used in laced bandages or boots.

The punching and insertion of the eyelets are rapidly done with the common instruments used for the purpose, which, with the eyelets, can be had at any tool-maker's.

The bandage is now complete. If it is thought desirable to strengthen it generally, or in any particular part, this may be done by glueing on fresh strips of linen. Its appearance may be improved by glueing on an edging of tape round the top and bottom, and along the sides of the slit. It is reapplied to the leg, and laced up as firmly as may be thought necessary. The lace, if it is not furnished with a tag, is best introduced on an eyed probe, and it should always be passed from without inwards. If the tag is introduced from within, it always gets entangled in the cotton-wool, and the process of lacing is extremely troublesome.

Thus a case is formed which is completely moulded to the shape of the limb, is very elastic, very firm, and very durable, and which can be accommodated with perfect ease to all the varying states of swelling of the limb. In situations where the roller cannot be conveniently carried round the part, the splint can be just as well formed by laying strips of linen in any direction and glueing them. The cotton-wool of course adheres to the first layer of the bandage, and comes off when it is removed. It is applied in the first instance, in great measure, to keep the glue from contact with the skin.

Paraffin bandage. — Mr. Lawson Tait having noticed in some cases, especially compound fractures and others involving discharges from wounds, that both plaster-of-Paris and dextrine or starch bandages have the disadvantage of becoming offensive by absorbing the discharges, has proposed, in order to obviate this, to use the ordinary paraffin of commerce applied with a flannel bandage of loose texture. The method which he has found most convenient is to have as much paraffin as is thought necessary melted and placed in a china bowl, which is to be immersed in hot water, to keep the paraffin in a liquid state. The bandage is to be passed through the melted substance as it is being applied; and as the paraffin melts at from 105° to 120° F., according to its quality, no fear need be entertained as to scalding the patient. After allowing five or ten minutes for the setting of the bandage, two or three coats of the liquid paraffin should be brushed over it so as to get a thickness of a fourth or three-eighths of an inch, and if necessary another saturated bandage placed over all.

The advantages claimed for this method are its cheapness—as paraffin sells at from fourteenpence to eighteenpence per pound—its extreme lightness, its cleanliness, its neat appearance, and that it perfectly resists moisture. It is very firm, and, if cracked, can be mended with a hot wire.

Silica bandage. — Mr. Wagstaffe used at St. Thomas's Hospital a stiff, large-meshed canvas bandage stiffened with silicate of soda alone, or in combination with lime in the form of common 'whitening.'

The silicate of potash in a neutral solution (soluble or water-glass) is to be preferred, and can be obtained at 2*d*. a pound. The bandages should be rolled in a basin of the solution when wanted.

The limb is to be left exposed to the air for about half an hour, but there is no fear of any of the silicate coming off after the first few minutes, and after half an hour or less (varying with the temperature) the bandage is firm enough to prevent movement. Moreover, the bandage continues to harden for about two or three days, at the end of which time it should be quite firm ; but it is usually firm enough in a few hours to insure immobility of the limb.

The solubility of the silicate in water is an advantage, for it renders the removal of the bandage easy.

Sand-bags are very useful adjuncts in the treatment of fractures, being laid on each side of the limb, with or without the addition of splints. Care should be taken that the material of which the bag is made is sufficiently fine to prevent the sand from getting out into the bed, and the sand itself should be the finest sea-sand, and thoroughly dried.

CHAPTER X

SPECIAL FRACTURES

Fractures of the skull are accompanied generally by the symptoms of either concussion or compression of the brain (p. 73). When, therefore, the injury to the bone is only slight, consisting merely of a simple depression or crack of the calvaria with more or less concussion, the house-surgeon may content himself with shaving the head and applying cold to it, conjoined with rest and darkness, unless more urgent symptoms should supervene, when the advice of the senior officer should at once be obtained.

When, however, the injury is complicated by a wound of the scalp, rendering the fracture compound, or if it is comminuted and symptoms of compression are present, no time should be lost in summoning the surgeon of the day, since any operative interference, to be of service, must be early ; and even should no operation be requisite, it is but right that, in cases which are always more or less ambiguous, the greatest experience should be brought to bear upon them. The house-surgeon must be careful not to mistake a bruise of the scalp (the margins of which are often so sharply defined as to resemble an edge of bone) for a fracture of the skull with depression. With a little care it can be satisfactorily made out that the depression is imaginary, and the fluctuation of the blood in the centre of the tumour will assist in the diagnosis. These cases must never be punctured, and only require time for the due absorption of the effused blood.

Fractures of the base of the skull may give rise to no special symptoms at first, and be only detected by the flow of blood and clear fluid from the ear after the patient is placed in bed. Immediate steps should be taken to disinfect the auditory meatus, by wiping it out with a probe carrying cotton-wool dipped in carbolic lotion 1 in 40, after which iodoform is to be blown in, and the canal lightly plugged with iodoform wool or gauze.

Fractures of the spine are generally complicated with serious damage to the spinal cord, producing paralysis of the parts below the seat of injury, or, if very high up, causing immediate death by cutting off the nervous supply to the diaphragm. Unless the case is one in which the surgeon feels justified in employing extension, time is the only means of cure, and the house-surgeon's care must be directed to the prevention of bed-sores and disease of the bladder, by placing the patient upon a water-bed from the first, and by drawing off the urine at frequent intervals, and washing out the bladder at least once a day (*vide* p. 91).

Fractured pelvis, resulting from a severe crushing force or a fall from a great height, is but too often complicated with rupture of some of the abdominal viscera, and especially the bladder. The house-surgeon's first care must therefore be to introduce a catheter and draw off any urine which the bladder may contain—the condition of which, bloody or otherwise, will help to the conclusion as to whether that viscus is injured or not. Bloody urine, though alarming, is by no means a certain sign of rupture of the bladder, since it may simply be caused by a bruise of the kidneys, bladder, or urethra (*vide* p. 28 for diagnosis). The most certain sign of rupture of the bladder is when no urine can be drawn off by the catheter, while it is shown by the history of the case that the bladder must have contained a considerable quantity at the time of the accident. If, as generally happens, the urine has passed into the peritoneum, nothing but prompt laparotomy and suture of the bladder can save the patient; but if fortunately the rupture has taken place in front of the membrane, it is possible that incisions may do good, and in any case, therefore, the visiting-surgeon should be summoned without delay.

Rupture of the urethra is occasionally caused by fracture of the pubic portion of the pelvis, and will possibly impede the passage of the catheter into the bladder, or subsequently give rise to extravasation of urine (p. 88).

Treatment.—Absolute rest being necessary, it is advisable to put the patient upon a fracture-bed, so as to avoid all disturbance when the bowels are relieved &c. A broad strip of leather plaster or a plaster-of-Paris bandage may be carried round the pelvis to keep the fractured portions in position, and, where the injury has comminuted the anterior part of the bone, the finger should be introduced into the rectum (or vagina) to restore the fragments as nearly as possible to their proper position.

Occasionally the whole acetabulum of one side is detached by a double fracture, and consequently is pushed up by the contraction of the muscles of the thigh, and it will then become necessary to make extension by means of a long splint, which may take its point of counter-extension from the opposite thigh, by means of a fillet similar to that recommended by Sir W. Fergusson for the treatment after excision of the head of the femur; or by a weight attached to the foot, with a counter-extending perineal band in the opposite groin.

Fractured nasal bones should be restored at once to their proper position by means of a director introduced into the nostril, and will generally keep in place without any plugging of the nostrils, provided the patient exercises ordinary care. These fractures are not unfrequently accompanied by emphysema about the root of the nose and in the eyelids, which may possibly be mistaken for commencing erysipelas. The best treatment is to paint the part with collodion, which, if repeated a few times, will exercise pressure sufficient to prevent further escape of air into the tissues.

In every case of injury to the nose it is well to examine the condition of the septum, since it may be displaced considerably with or without fracture. If displaced, it should be at once carefully restored, under chloroform, by means of a strong director or other suitable instrument introduced into the nostril, and it may be necessary to plug one nostril for a time to keep the septum in its place. Great care should be taken to injure the mucous membrane as little as possible.

Fractured lower jaw, in hospital practice, is generally the result of a blow with the fist, and seldom of a fall, though the patient may assign the latter as the cause of the accident. Care should be taken to examine all the teeth, to see that a tooth has not dropped into the fissure between the broken portions, as sometimes happens, particularly in the molar region.

If the fracture is near the symphysis, it is advisable to pass a piece of stout silk round the adjacent teeth so as to bind the fracture together ; but this cannot be accomplished far back in the mouth. The wedges of cork &c. which are recommended are, in the author's experience, unnecessary and useless, since they cannot long be kept in position, and then roll about the mouth, to the patient's great annoyance. It has been recommended to mould pasteboard or gutta-percha to the jaw externally, so as to form a splint for it ; but in the majority of cases the following bandage alone will be found to form a quite sufficient and satisfactory treatment.

A bandage, three inches wide and a yard long, should have a slit four inches long cut in the centre of it, parallel to and an inch from the edge, and the ends of the bandage should be split to within a couple of inches of the former slit, thus forming a four-tailed bandage with a hole in the middle. The central slit can now be adapted to the chin, the narrow portion going in front of the lower lip, and the broad beneath the jaw ; and the two tails corresponding to the upper part of the bandage are then to be tied round the nape of the neck, while the others are crossed over them, and carried over the top of the head, as shown in the illustration (fig. 123).

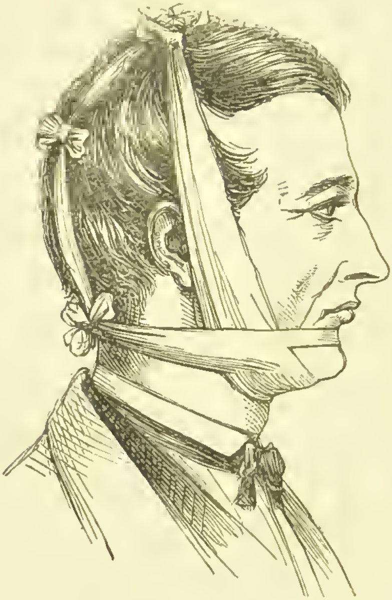

Fig. 123.

In bad cases of double fracture, a metal 'plate' lined with gutta-percha, and fitted by a dentist upon the teeth, or Hammond's inter-dental wire splint, is the most satisfactory mode of treatment.*

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* The various forms of apparatus for the treatment of fractured jaw will be found at length in the author's work on *Injuries and Diseases of the Jaws*, 1894.

Fractured ribs are often very difficult of accurate diagnosis, especially if the patient is fat; and in cases of doubtful injury to the thorax it is as well, therefore, to apply a broad flannel bandage at once, which generally gives great relief.

When a fracture can be clearly made out, the application of a broad piece of plaster, or, better, of straps overlapping one another slightly, from the spine to the sternum of the affected side, will be the best treatment, since the movements of the sound side are thereby less interfered with than when the bandage is used.

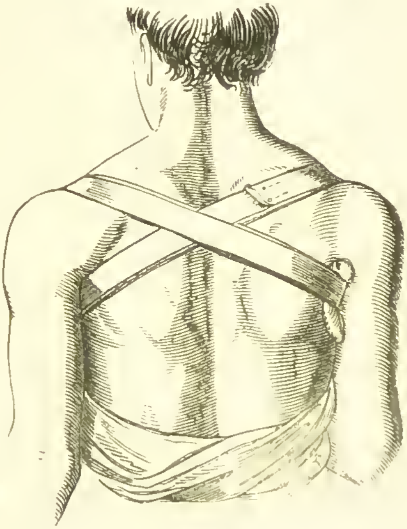

FIG. 124.

Cases of injury to the thorax, by crushes &c., with or without fractured ribs, are materially relieved from the consequent dyspnœa by small doses of tartar emetic, given for a day or two after the accident.

The possibility of lung complications within a few days after fractured ribs, especially in old and very young patients, should not be forgotten. Old patients had better be admitted at once, and all others should be kept under observation.

Fractured clavicle.—More forms of apparatus have been contrived for the treatment of this fracture than for any other, but the following are the methods most in use in hospital practice.

A pad being placed in the axilla of the affected side, a figure-of-eight bandage is taken round the shoulders and behind the back; wool being carefully adapted to prevent rubbing at the axillæ. This may be conveniently effected by folding some split cotton-wadding around a piece of bandage and stitching it along the front and back. The shoulders being thus drawn back, the arm is fastened to the side by a few turns of bandage, being at the same time pushed outwards by the axillary pad, while the forearm is carried in an ordinary sling (fig. 124).

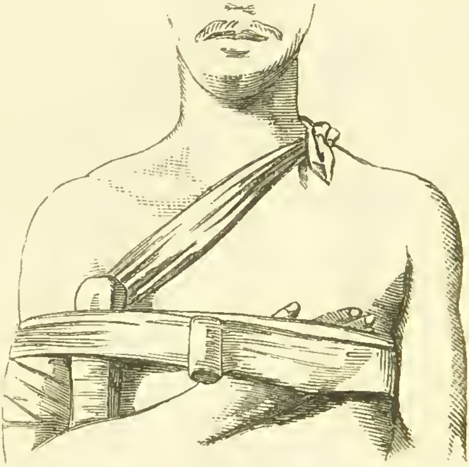

FIG. 125.

The disadvantage of this arrangement is the uncomfortable drag of the bandage behind the shoulders, which is very irksome to the patient unless he continues in the horizontal position.

In the second method, a firm pad, three inches thick at the upper part, but diminishing to an inch at the lower end, which should be halfway down the humerus, is to be fastened into the axilla of the affected side by means of a piece of bandage stitched to it and tied over the opposite shoulder. A bandage being taken twice round the middle of the humerus, so as to get a firm hold, is then to pass *behind* the body and a few times round the chest, enclosing the humerus and binding it firmly to the side and in a vertical direction (fig. 125). (The bandage is directed to be taken across the back first, to counteract the tendency there is to cross the humerus over the chest.) The forearm, being now laid across the chest with the hand towards the opposite shoulder, is to be enclosed in a regular series of turns round the body, a few of which should be made to pass under the elbow and over the opposite shoulder, so as to keep the arm from dropping down.

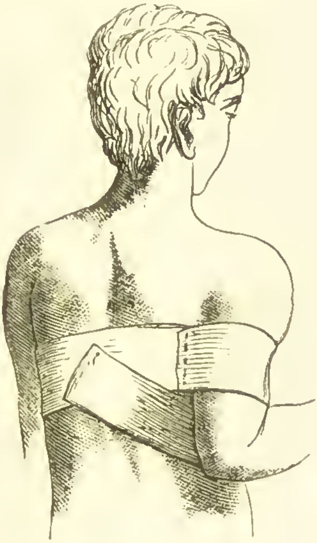

Fig. 126.

To keep the apparatus firm, the bandages should be carefully stitched both along the front and back of the axillary pad and around the elbow; or, if the surgeon choose, he may add plaster-of-Paris or starch to the above arrangement, and so thoroughly fix the parts.

A very efficient plan of treating fractured clavicle is with two broad straps of stout twilled calico plaster, as recommended by Dr. Sayre.

The first strap is looped round the arm just below the axillary border, with the adhesive side outward, and pinned or stitched, with the loop sufficiently open to avoid strangulation. The arm is then drawn downward and backward until the clavicular portion of the pectoralis major is put sufficiently on the stretch to overcome the sterno-cleido-mastoid, and thus draw the sternal fragment of the clavicle down to its place. The strap is then warmed, and being carried round the body is fixed to it, and for better security is pinned or stitched to itself behind (fig. 126). The

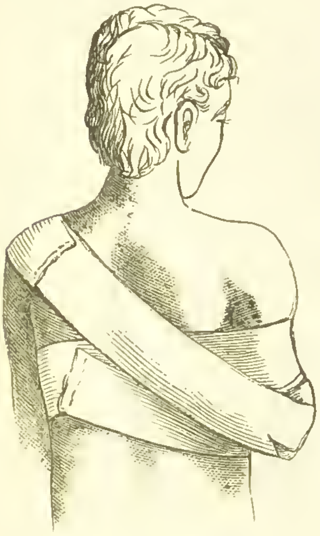

Fig. 127.

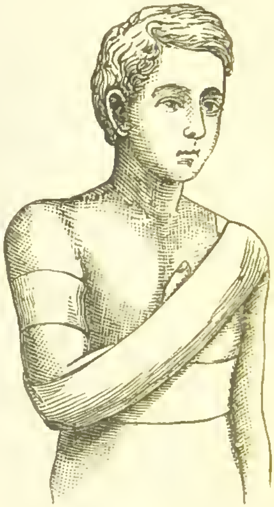

Fig. 128.

second strap, having a longitudinal slit for the elbow, is to be thoroughly warmed and fixed upon the shoulder of the sound side and carried across the back to the elbow of the affected side, which is to be fitted into the slit. The elbow is now to be pressed a little forward so as to bring the arm vertically to the side, when the strap is to be carried across the front of the chest to the shoulder, and there stitched, thus enclosing and fixing the forearm and hand (figs. 127 and 128).

The effect of this is to convert the humerus into a lever, of which the first strap is the fulcrum, and thus to maintain the broken clavicle in position. A third strap may be advantageously put round the chest, arm, and hand, to keep the limb fixed; or, still better, a few turns of plaster-of-Paris bandage may be applied over the plaster, which, however carefully applied, is apt to become loosened in time.

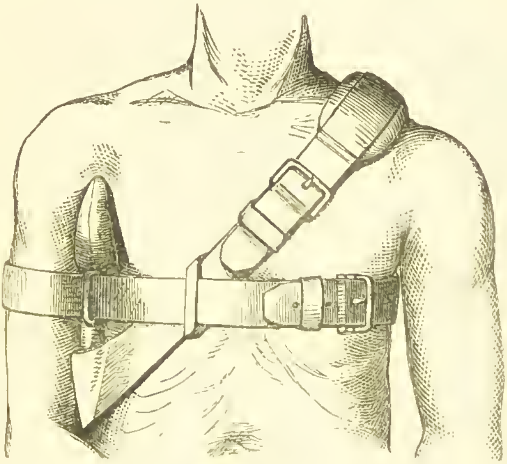

FIG. 129.

Ellis's apparatus for fractured clavicle is a simple and efficient contrivance, which meets all the requirements given above, and is shown in fig. 129. Its great advantage is the very serviceable crutch-pad, which is efficiently supported by the strap passing over the shoulder, and should be protected by a fold of flannel from the perspiration of the axilla. The strap passing round the body encloses the upper arm, and keeps it perpendicular and fixed to the padded support of the crutch, and thus the arm is prevented from being crossed over the chest. The hand should be supported by a simple sling.

Fractured humerus.—If the fracture is near the upper extremity of the bone, it may be conveniently treated with a rectangular wooden splint which is well padded at the top so as to form a sort of crutch in the axilla, or with a rectangular iron splint, to which a crutch is fitted with a screw so as to permit of extension being made in the axilla (fig. 130). In using this it will be necessary to bandage the forearm and lower part of the humerus carefully to the splint before the screw is turned; and care must be taken not to press the crutch so forcibly into the

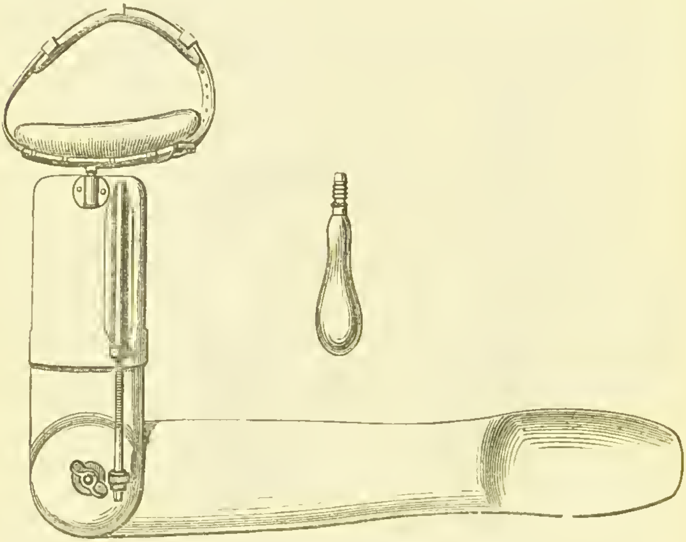

Fig. 130.

axilla as to produce œdema of the limb. This splint is sometimes fitted with a cap to pass over the shoulder and along the outside of the humerus, which may be used or not, at the fancy of the surgeon.

Another method is to place only a pad in the axilla, and then to mould a firm gutta-percha splint to the shoulder and outside of the arm as far as the elbow. A bandage is next to be carefully applied over the splint and around the thorax, the walls of which, together with the pad, prevent displacement inwards. The hand and forearm should be bandaged, and the hand carried in a sling, which should not extend beyond the wrist, so as to allow the weight of the arm and elbow to draw upon the fracture. Plaster-of-Paris or starch may be advantageously used to keep the parts firmly in position (fig. 131).

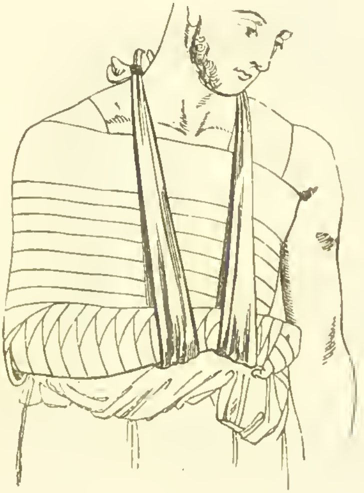

FIG. 131.

An internal poro-plastic splint may be applied to the arm and forearm, the upper end of which, reaching well into the axilla, is to be doubled down as suggested by Mr. Pollard, and a poro-plastic cap being fitted to the shoulder, a spica bandage can be applied over all (*v.* Erichsen, fig. 187).

Fractures of the shaft of the humerus may be conveniently treated with three straight splints, which can be cut to the required length out of Gooch splinting. The forearm being flexed, one splint is placed on the inside of the arm, reaching from the axilla to the inner condyle ; and care must be taken that the pad a little overlaps the splint at the upper part, or it may excoriate the armpit. A second longer splint is placed on the outside of the arm, reaching from the acromion to the external condyle ; and a third (or fourth if necessary) may be placed in front or behind, between the other two. These may be bandaged to the arm ; or, as shown in the illustration (fig. 132), a couple of linen straps and buckles may be used. The forearm may be placed in a sling (fig. 111), taking care that the elbow is not pushed up ; or, better, the whole arm and forearm may be covered with a bandage

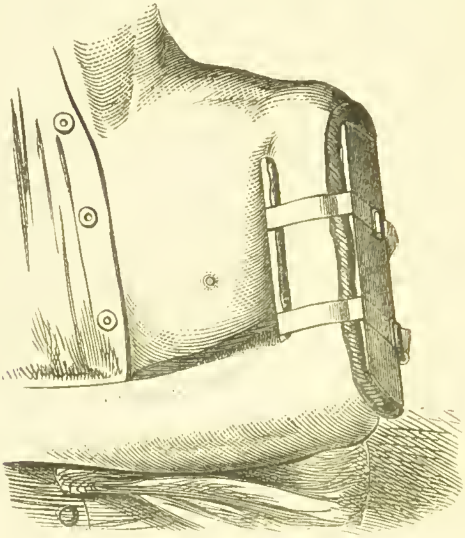

Fig. 132.

passing round the thorax so as to secure immobility of the shoulder-joint.

A rectangular splint on the inside alone, or on both sides of the arm, and reaching to the wrist, may be used, care being taken to pad thickly near the condyles, or, what is better, to have a hole cut in the splint to fit the projecting bone. The straight splints, figured above, may be conjoined with the rectangular inside splint, or the plaster-of-Paris bandage may be employed alone, or in addition to other apparatus.

Fractures at the lower end of the humerus in adults are best treated with an inside rectangular splint; and when the injury involves the elbow-joint, care should be taken that it is not injuriously compressed by the bandages. In fact, it is better to avoid taking the bandage over the joint at all, so as to allow of the application of fomentations or evaporating lotions if necessary. In children, separation of the lower epiphysis of the humerus is best treated without any splint, the elbow being thoroughly flexed and the arm bound to the padded chest.

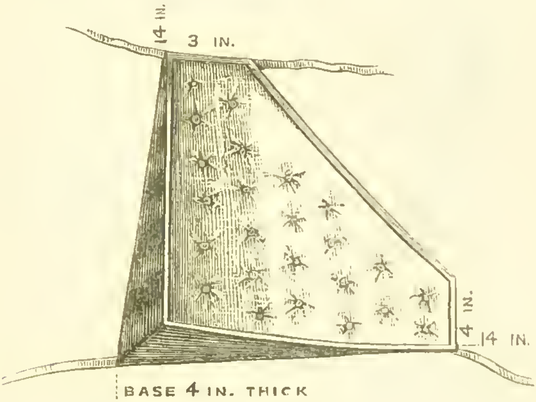

Fig. 133.

Complicated injuries of the humerus or elbow-joint may be satisfactorily treated, so long as the patient is in bed, with Stromeyer's cushion (fig. 133). The measurements here given are those for an ordinary man, but can be easily modified to suit each case. The cushion should be made of folded blanket or some firm material, and, when there is an open wound, be protected with waterproof.

The cushion is fastened with one tape round the neck and one round the body, and when the patient is recumbent the arm lies upon it without any other support (fig. 134). When, however, the patient is able to sit up, it will be necessary to pin a broad bandage round the arm and body.

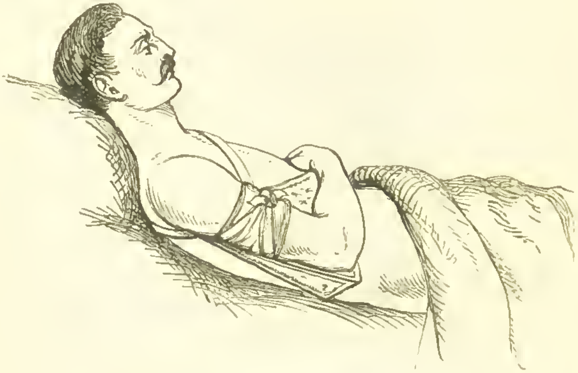

Fig. 134.

Fractures of the forearm.—The treatment will be the same, whether the shaft of one or both bones of the forearm is fractured. Two light wooden splints, better made of Gooch splinting than of rigid boards, are ordinarily used, but surgeons differ as to their length, some carrying the splints to the tips of the fingers, while others make them reach only to the wrist. It will, however, be found most satisfactory to have the splints long enough to reach to the metacarpal bones, so as to prevent motion in the wrist-joint, but not to interfere with the movements of the fingers (fig. 135). Care should be taken, in selecting the splints, to have them very little wider than the limb itself—only enough, in fact, to take off the pressure of the bandage, since otherwise the limb will roll about between the splints, and a very indifferent cure will be effected.

The splint for the front of the arm must be a little shorter than the other, to allow of the elbow being easily flexed ; and in padding the splints care should be taken to make the stuffing rather thicker in the centre than at the sides.

Although the position which the arm will ultimately assume will be between pronation and supination, in setting the fracture and in first applying the splints the limbs should be *supinated*, by which step the bones will be brought parallel to one another. Having satisfied himself that the broken bones are in proper apposition, the house-surgeon should then gently lift the limb on to the back splint and lay the front one upon it ; next, grasping the two ends of both splints firmly, he should bring the arm into a position midway between pronation and supination, and hold the splints while an assistant passes a strap of adhesive plaster around each end of them, so as to fix them securely (fig. 135). By thus avoiding all muscular action on the part of the patient, the chances of displacement are greatly diminished, and the bones will probably be in much better position than if the

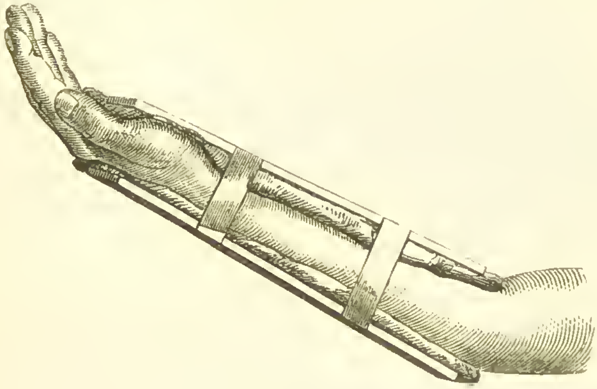

FIG. 135.

splints are put on after the rotation has been made. A bandage can afterwards be applied over the splints, and the arm suspended in an ordinary sling.

A single splint is sometimes made use of, and a convenient form, made by Allen & Hanburys, is shown in fig. 136, which consists of two aluminium plates held together by a jointed rod, to which the plates are clamped so as to be capable of taking any position. The plates can be used separately or in combination, and can be applied to the inside or outside of the limb as preferred, and thus may be used for fractures of either upper or lower arm or even for the leg in children.

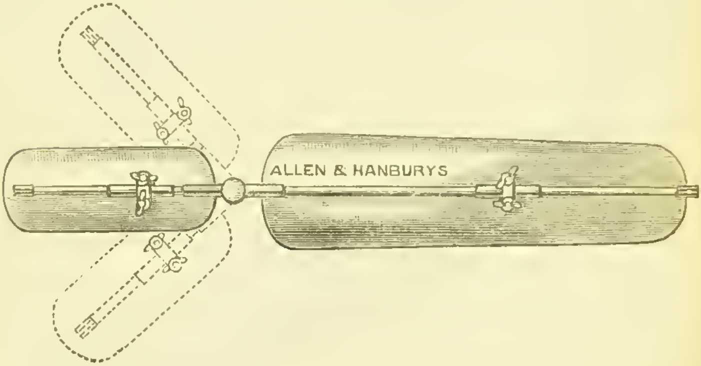

Fig. 136.

In children the bones of the forearm may be bent or partially broken ('green-stick fracture'). In either case chloroform should be given, and the bones be forcibly bent back into their proper shapes, even at the expense of a complete fracture of the ulna, for if this is not done at once great permanent deformity will ensue.

Colles' fracture.—For the treatment of this fracture of the lower end of the radius it is necessary that the hand should be adducted ; and for this purpose such a splint as is shown in the illustration (fig. 137), or a more perfectly pistol-shaped one, as preferred by some surgeons, may be employed. The practice varies as to which side of the limb the splint should be applied; most surgeons, however, preferring the palmar aspect. In applying the splint, the limb should be firmly grasped, and the hand adducted until the bones come into proper position, when the splint may be applied to the palmar surface and held there while a strap of plaster is applied round the hand, and another round the upper part of the forearm, to keep the limb in the necessarily strained position. A bandage should afterwards be applied over the hand and at the upper part of the forearm, but not over the seat of fracture, as it would tend to displace the broken ends.[1]

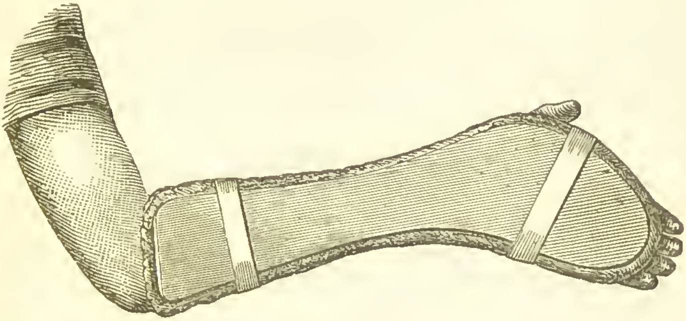

FIG. 137.

Carr's splints for Colles' fracture are of American origin, and give better results than any others, by allowing motion to the fingers and thus preventing stiffness. The palmar splint is thickened on its radial border, in order to press against the broken bone; and the angle at which the bar for the hand to grasp is set (fig. 138) gives considerable power of adduction. The deformity having been forcibly reduced, the arm is laid upon the splint, covered with a double fold of flannel, and a few turns of bandage being made round the middle of the forearm, the hand is made to grasp forcibly the bar. The dorsal splint is then applied

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[1] *Vide* illustration with pistol-splint applied to the dorsal surface, in Erichsen's *Science and Art of Surgery.*

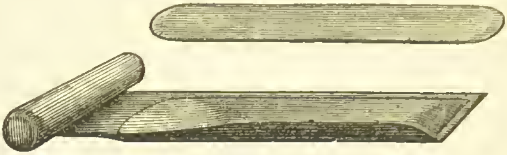

Fig. 138.

with a fold of flannel beneath it, and the two splints are firmly bandaged on, the fingers being unbound after a couple of days, so that they may be freely exercised

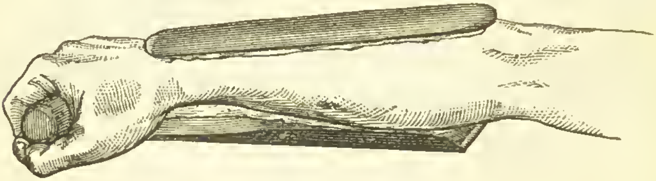

Fig. 139.

(fig. 139). The back splint may be left off at the end of a fortnight, and the palmar after four weeks.

Fractured metacarpal bones.—If one of the central metacarpal bones is broken (generally in fighting), it will be most efficiently treated by placing a stout ball of tow in the palm, and then flexing the fingers forcibly upon it until the fracture is reduced, when the hand must be retained in position by bandaging the fingers firmly down to the wrist, the metacarpal bones being left uncovered. If one of the lateral bones or that of the thumb is broken, a palmar splint, of either wood or gutta-percha, and thickly padded, may be employed; and it may be necessary to flex the fingers over the top of the splint before the broken bone can be properly adjusted.

Fractured phalanges are readily treated with a splint of wood or gutta-percha, and a bandage similar to that figured for the finger (p. 232). It will be found convenient to pad the splint by wrapping it up in a suitable piece of lint two or three times folded; and it will be best to make it long enough to reach well into the palm of the hand.

Fractured thigh.—The long splint, with a perineal band, is one of the commonest modes of treating fracture of any part of the femur. In applying it, care must be taken to select a splint long enough to reach from the lower part of the axilla to a few inches beyond the heel, and that in children the splint is not wider than the thickness of the limb, or it will be impossible to prevent the thigh from rolling beneath the bandage. A useful addition to the long splint is a small wooden cross-bar, fastened below the splint, and a few inches from its lower end. This both obviates injurious pressure upon the patient's heel, and prevents the rolling of the limb to one side, and is therefore a great assistance, especially in cases of hip-disease. In some hospitals Desault's splint with a foot-piece is preferred to the plain lath commonly known as Liston's splint.

The perineal band is a most important part of the apparatus, and is best made of a piece of soft cotton bandage stitched so as to form a long narrow bag, and then stuffed with cotton wool. This should be long enough to reach from the middle of the groin to the corresponding point behind, and to each end of it should be attached stout tapes, which will work much more easily through the holes in the top of the splint than any bandage. It has been recommended to cover the perineal band with oil-silk; but it will be found that the perspiration, to say nothing of the urine in the case of children, will soon cause the oil-silk to fray out and excoriate the groin. If it is desired to use some waterproof material, the thin india-rubber cloth will be found to be the best.

To apply the long splint.—The splint having been carefully padded, and the perineal band prepared, the house-surgeon should envelop the ankle in cotton-wool, and then make two or three figure-of-eight turns with the bandage around it, so as to get a firm hold on the foot. Then placing the splint by the side of the limb, the bandage is to be carried around its lower end and through the notches cut for the purpose, so as to fix the foot; great care being taken to insert cotton-wool wherever there is any pressure, and to avoid crushing the smaller toes against the splint. The bandage is then carried regularly up the leg; and it will be found that the figure-of-eight method can be advantageously used all the way, without any 'reversed turns,' the crossings of the bandage being made along the line of the splint. The knee having been included in the bandage (unless the fracture is very low down), the perineal band should be adjusted; and one assistant should then make extension on the foot, while another tightens the perineal band, until the house-surgeon is satisfied, by manipulation and measurement, that the fracture is properly set, and that the limb corresponds with its fellow in length. The tapes of the perineal band should then be carefully tied, and a broad roller must be carried round the thorax to confine the upper end of the splint; but the bandage on the thigh need not be carried any higher, since the seat of fracture is best left exposed (fig. 140). When the fracture is high up in the shaft, some surgeons prefer to add a small straight splint to the above, placing it over the fracture, and securing it with a couple of straps and buckles; others, again, employ, in all cases, three splints to surround the thigh, in addition to the one on the outer side.

A sand-bag laid along each side of the limb will help materially in keeping the limb quiet; and, in children or unruly patients, it will be well to fasten a broad bandage or sheet over the thighs and trunk, so as to prevent attempts at sitting up &c. In very young children, it will very much relieve the irksomeness of the confinement if a hole is cut in the bandage or sheeting, through which the *sound* leg can be kicked about as much as may be desired without detriment to the fractured limb, which may, for additional security, be fastened by a bandage to the bottom of the bed.

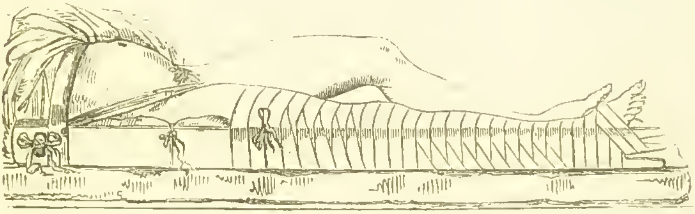

Fig. 140.

The constant wetting of the bandages with urine is a great drawback in the treatment of children, and may be best combated by smearing the upper part of the thigh bandage with plaster-of-Paris and afterwards varnishing it, and by changing the perineal band occasionally, unless made of india-rubber cloth.

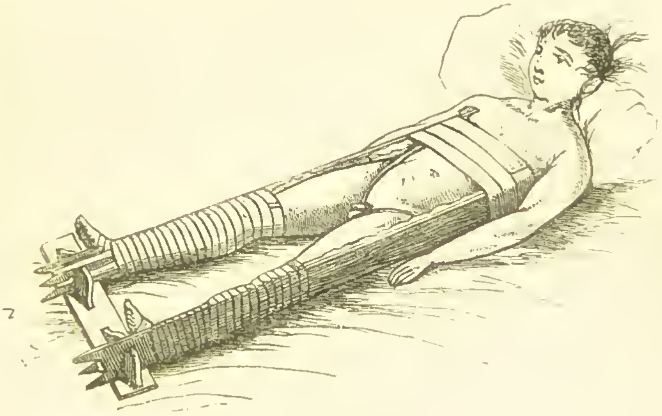

Fig. 141.

Hamilton's plan of applying a long splint to each thigh, the two splints being fitted into a cross-bar at the feet, is exceedingly useful in children, who can then be lifted with the greatest ease, and turned from side to side for washing &c. (fig. 141). It is not necessary to apply a perineal band on the sound side, and the bandage round the trunk may be advantageously replaced by a broad belt of plaster.

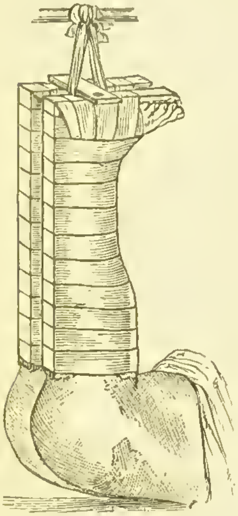

FIG. 142.

In infants a very convenient method is to encase the thigh with plaster-of-Paris or apply a couple of light splints, and then to bend the thigh to a right angle and suspend it from the cradle by the foot, as recommended by Mr. Bryant. It will be found most convenient, however, to suspend both limbs (fig. 142).

Plaster-of-Paris or starch may be advantageously used from the first, without splints, and no special directions need be given for their application; or they may be added to the long splint, so as to prevent all possibility of movement.

The double-inclined plane, if used, may be formed of an ordinary MacIntyre iron splint, screwed to the proper angle; or, what is preferable, a wooden stand made to fit the bed, on which a double incline can be at once made to any height, may be employed. Most forms of fracture-bed allow of this position being assumed, and in cases of severe compound injury, or fracture of both limbs, recourse may be had to this method of treatment at once.

Extension by straps of plaster.—The practice of making extension by means of straps of adhesive plaster having come into vogue in America, it has been adopted by many surgeons in this country, and has the advantage of obviating injurious pressure about the ankle. A strip of plaster, two inches wide, is cut long enough to reach from immediately above the knee to the sole, and up again on the opposite side of the limb, leaving a loop eight or ten inches long below the foot. This is carefully applied to the limb; a strip of plaster or a bandage is carried over it, so as to prevent its slipping; and a piece of wood may be placed in the loop and across the sole of the foot, to prevent this being pressed upon by the plaster (fig. 143).

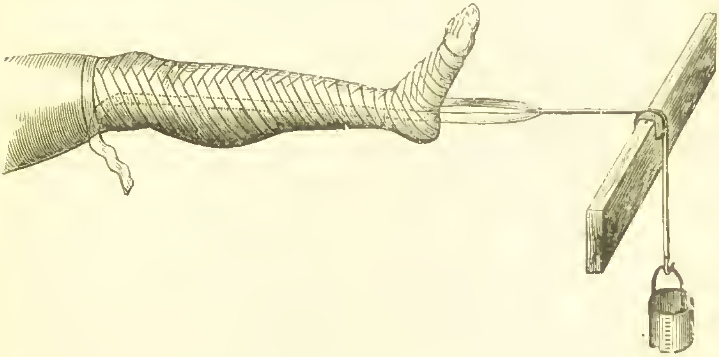

Fig. 143.

The loop at the middle of the plaster, which, it will be observed, exercises traction without compressing the ankle, may be secured in one of the notches of the ordinary long splint, or, the splint being loosely attached to the limb, extension can be made with a weight. Those surgeons who employ Desault's splint with a foot-piece (St. George's Hospital), generally fix the foot with a bandage carried over the ankle, and then extend both splint and limb by a weight attached by strips of plaster (fig. 144). Extension may be produced without a splint by attaching a weight to hang over the end of the bed, as shown in fig. 143, and fixing the patient by means of a perineal band attached to the head of the bed; or, if preferred, the foot of the bed may be raised so as to prevent the patient slipping down.

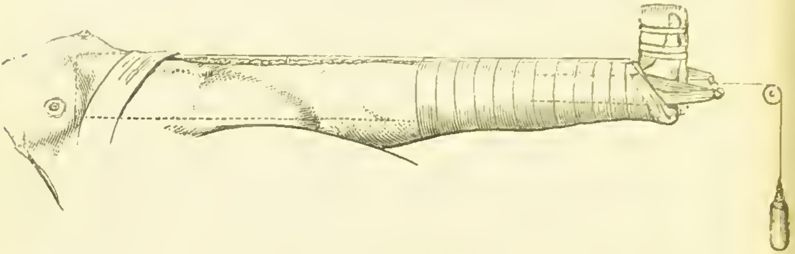

Fig. 144.

By employing a pulley for the rope to work over this contrivance is rendered more perfect. Fig. 145 shows a double pulley fitted to the bed and carrying a flat-linked chain, which is in use in University

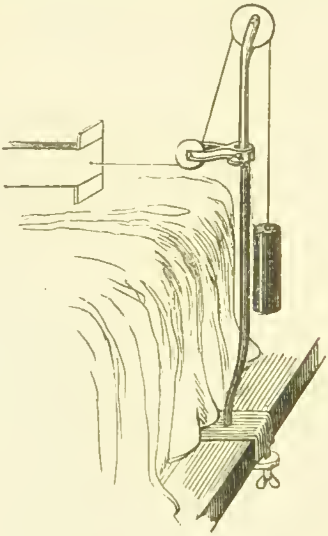

Fig. 145.

College Hospital, and by which the line of traction can be readily adapted to suit each case.

An American mode of making extension is by using a long splint with a perineal band, and a cross-bar going below the sole of the foot. The limb is not bandaged to the splint; but extension is produced by a loop of plaster, which is acted on by a tourniquet or some similar contrivance, attached to the cross-bar, and thus any degree of extension can be made.

Another method, introducing the use of an india-rubber band to keep up constant extension in cases of fractured thigh, was employed by Mr. de Morgan at the Middlesex Hospital. A long splint is fitted, about six inches from its lower end, with a cross-bar, which passes beneath the foot, and has three small pulleys fixed in it—one in the foot-piece, and one at each end of the splint. A loop of plaster being arranged as above directed, a cord is attached to it and passed over the pulleys in the foot-piece and lower end of the splint, and up the outside of the splint, where it is attached to an india-rubber 'accumulator,' or door-spring. The other end of the india-rubber is attached to another cord which is carried over the upper pulley, and attached to a well-padded perineal band, as shown in fig. 146. If the length of the ropes is properly adjusted, the spring is kept in constant action, and extension is maintained.

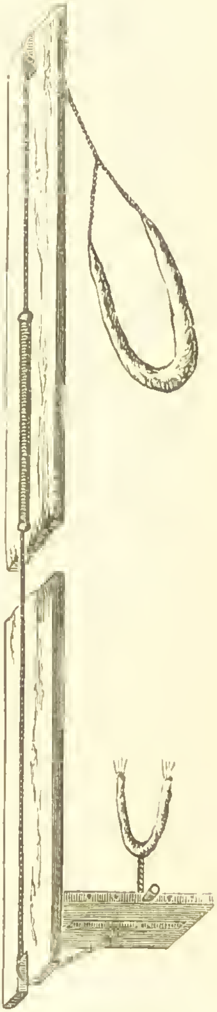

Fig. 146.

In order to facilitate this, Mr. de Morgan employed a piece of hard wood four inches long, an inch broad, and half an inch thick, in which are three holes, to one of which the india-rubber is attached, whilst the end of the upper cord passes through and is firmly held by the other two. By this the cord can be easily tightened after the manner of the ropes of a tent. Bryant's double thigh-splint (fig. 171) is useful for fractured thighs, and particularly for fractured neck of the femur.

Hodgen's suspension splint (fig. 147) is extensively used at Guy's Hospital with good results. The wire frame is kept in several sizes, and the limb is supported by a series of pieces of flannel bandage attached to the bars. Extension is made by a loop of plaster, which should be carried above the knee and then be firmly fixed to the leg by strapping. It is then attached by a cord to the lower cross-bar of the splint. The pole from which the limb is suspended

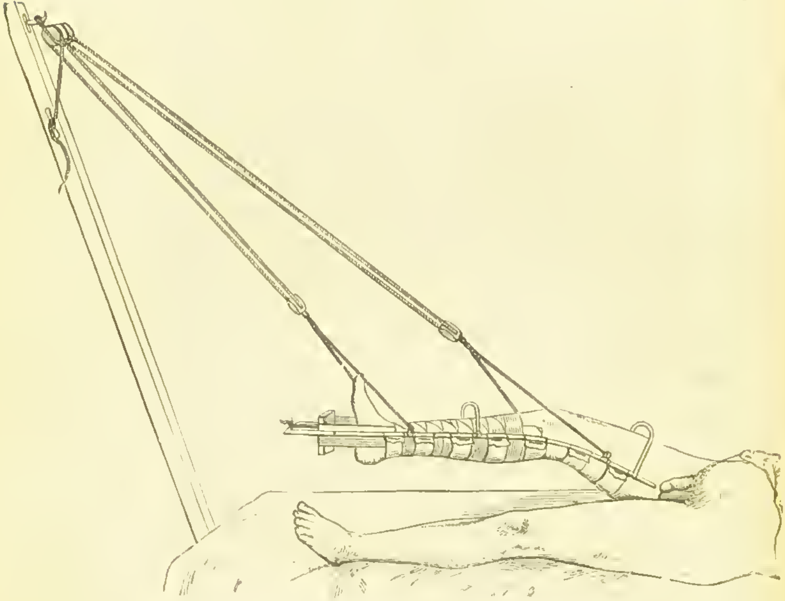

FIG. 147.

rests on the floor and is clamped on to the end of the bedstead, and the cords passing through the pulleys are adapted as may be necessary.

Thomas's knee-splint (fig. 151) may be conveniently used for the treatment of fractured thigh in children or in old people, whom it is undesirable to keep recumbent for long.

Thomas's splints.—For the treatment of disease of the hip and knee joints, Thomas's splints are very useful if applied properly. The hip-splint (fig. 148) consists of a piece of flat malleable iron, from three-quarters to one and a quarter inch in width, and from three-sixteenths to one-quarter of an inch thick, long enough to extend from the lower angle of the scapula, perpendicularly over the buttock and back of the thigh, to the middle of the leg. Metal hoops attached to this encircle the thorax, the upper part of the thigh, and the middle of the leg, which they are to fit accurately. The splint is lined with a layer of felt, and covered with 'basil leather,' and is attached to the body by straps over the shoulders and round the waist, and a bandage round the thigh.

One great advantage of this splint is that it permits of the patient getting about upon crutches, while wearing a patten on the *sound* side so as to raise the foot of the diseased side completely off the ground (fig. 148). A caution is necessary, that a child's patten requires to be higher than an adult's, or it will be found to put the diseased limb to the ground.

In cases of early hip disease there is no difficulty in fitting the splint to the patient, who should stand with the foot raised on a block so as to bring the pelvis straight. In more advanced cases, where the thigh is flexed, it will be advisable to employ a double Thomas's hip-splint (fig. 149), in which the sound limb is firmly bandaged whilst the flexed limb is supported by soft padding. It will be found sufficient to lay the patient in the splint, so that he may be absolutely on his back, when in recent cases the weight of the limb will gradually stretch the muscles and ligaments, and in a few days bring it down into the splint, the padding being reduced as the limb drops into the splint (fig. 150). Or, in old cases, the iron bar must be bent up to fit the back of the flexed limb, and then gradually straightened, with the limb in it, by means of a suitable 'wrench.'

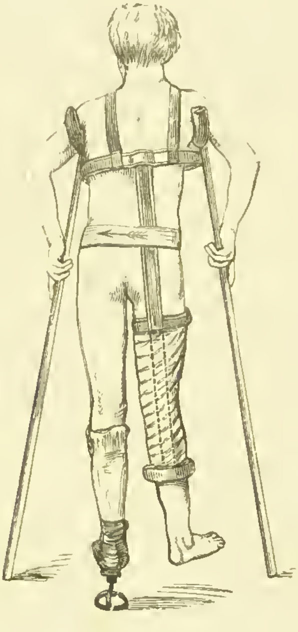

Fig. 148.

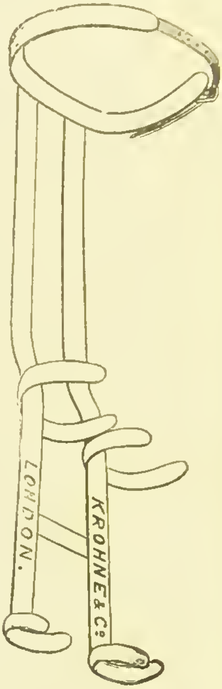

Fig. 149.

The knee-splint (fig. 151) consists of an ovoid iron ring, three-eighths of an inch thick, varying in size according to the age of the patient, and covered with felt and basil leather. From this two iron rods pass down the sides of the thigh, the inner one forming an angle of 55° with the ring, and are inserted into a patten carried some inches below the foot. Across the two iron rods is stretched an apron of basil leather to support the limb; but this is practically useless, and had better be removed, the limb being fixed with straps of plaster. A patten is to be worn under the shoe of the sound limb, so as to bring it to the same length as the splint, which, when properly fitted with a strap over the shoulder (fig. 152), transmits all shocks directly to the pelvis, leaving the knee at rest.

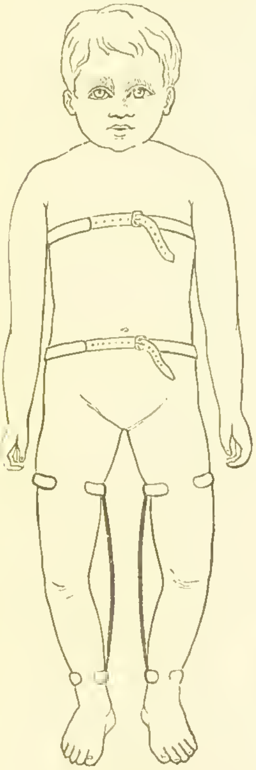

Fig. 150.

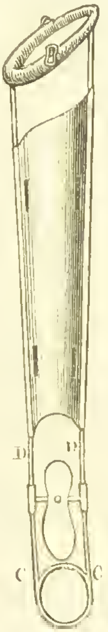

Fig. 151.

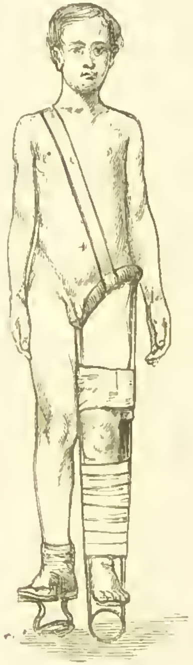

Fig. 152.

The success of this splint, as a means of fixing the knee, depends altogether on its being properly applied. Immobility of the limb must be secured in the longitudinal, lateral, and antero-posterior directions. Two strips of strapping, about three inches wide, and long enough to reach from the head of the tibia to twelve inches beyond the sole of the foot, should be prepared and fixed along each side of the leg; they should be secured by another strip about an inch wide, wound spirally round the leg, and by a flannel bandage applied over all from the ankle to the knee. The splint should next be put on and pressed firmly upwards, so that the collar at the upper end rests against the tuber ischii, and then the free ends of the pieces of strapping above described should be fixed to the ring at the lower end of the splint; by this means longitudinal displacement is checked. Transverse and antero-posterior displacement must be prevented by applying transverse strips of strapping round the limb and the splint, opposite the middle of the thigh and the middle of the leg, in the following manner:—A piece of strapping about three inches wide should be fixed round one of the lateral bars of the splint opposite the calf of the leg; the strapping should then be carried beneath the leg and round between it and the opposite longitudinal bar of the splint, and returned to the bar from which it started. It should next be carried beneath the limb to the opposite bar, round which it should be passed at a slightly higher or lower level than on its fellow; the strapping should finally be carried round the leg, between it and the bar from which the strapping originally started, and should be finished off by encircling the entire splint. The piece of strapping for the thigh should be applied in a similar manner, but it should start from the opposite bar. A third piece of strapping should be carried from bar to bar behind the limb, opposite the popliteal space, and a flannel bandage should be put on over all, from just above the ankle to the groin.

The foot-piece shown in fig. 151 is added for cases of disease of the ankle and foot, and slides up and down between C and D, where the rods must be strictly parallel.

For the treatment of caries of the spine a modification of Thomas's double hip-splint, shown in fig. 153, may be employed. The child is kept recumbent and still, and can be lifted readily without giving pain. In cases in which flexion of the thighs exists the recumbent position will in most cases remedy the malposition, the limb gradually dropping into the splint. In order that no injurious pressure may be made on the child's back, it is important that it should be placed on a soft bed, into which the splint should slightly sink.

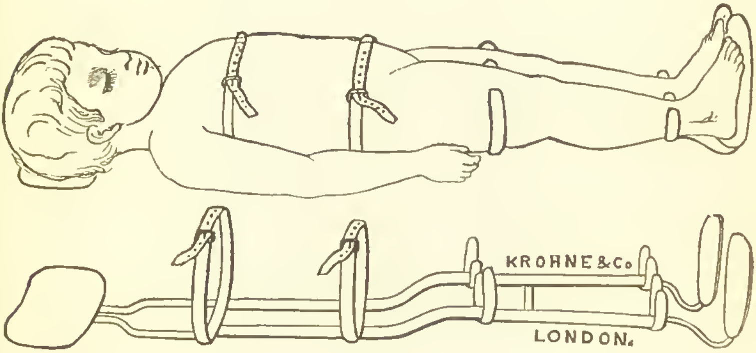

FIG. 153.

Phelps's box for spinal cases (fig. 154) is strongly recommended by Mr. Cheyne (*British Medical Journal*, June 25, 1892) for cases of angular curvature in which the spinal cord is involved.

It is a trough of wood, in which the patient lies, having two narrower troughs diverging from each other for the lower extremities (fig. 154). The box is made somewhat broader than the patient, so as to allow for lateral pads which fix him, while he rests on a mattress or pads so arranged as to avoid undue pressure on the curvature. Opposite the buttocks the wood is hollowed out so as to permit defæcation.

The sides of the trough are about six inches high for the trunk, and lower for the legs; they are hollowed out opposite the shoulders, so as to allow free play for the arms. At the feet there are vertical pieces of wood to which the feet are bandaged, a pad, of course, intervening. It is well to continue the splint about

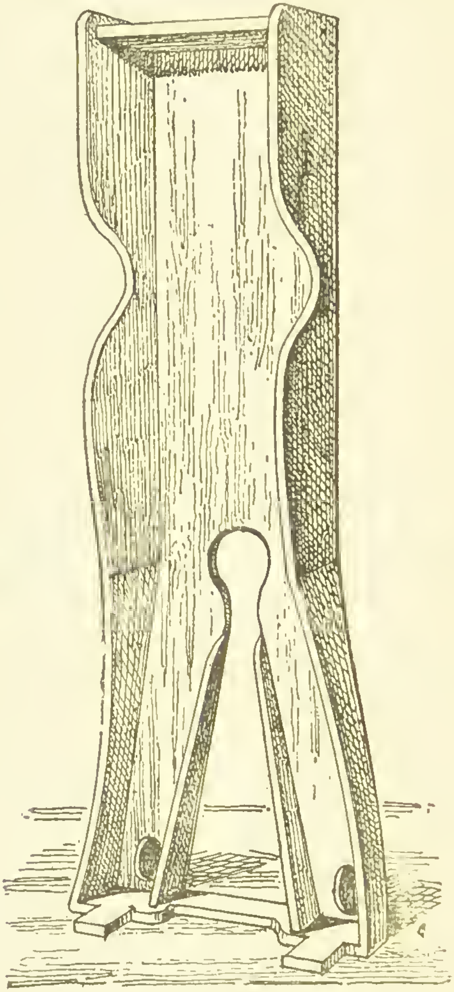

Fig. 154.

eighteen inches above the head, so as to allow room for elastic extension attached to bands under the chin and occiput, and to buckles at the top of the splint. The patient is carefully wedged in with pads and

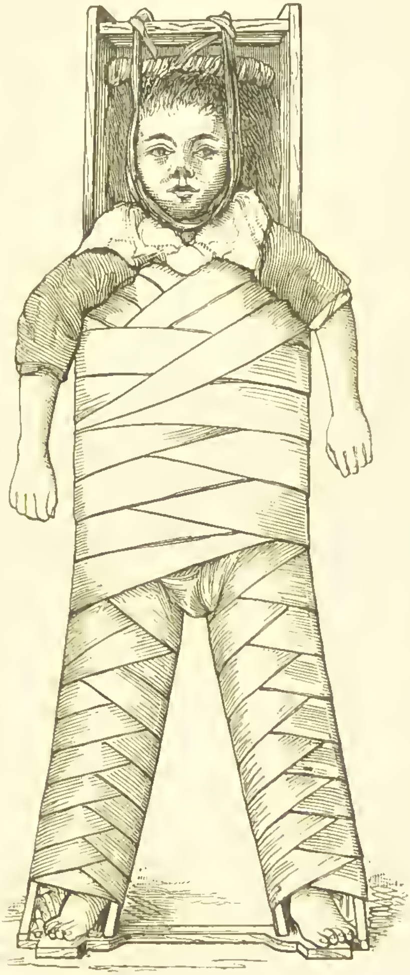

Fig. 155.

bandaged to the splint (fig. 155). In this apparatus the child lies at absolute rest, and is easily carried about. Further, if the head extension is applied, and the lateral pads carefully wedged in, the box may be tilted up so that the patient can look out of the window, play at a table, &c. Defæcation and micturition are performed without disturbing the patient. By undoing the bandages the front and sides and limbs of the child are easily washed without any disturbance, and when it is necessary to wash the back, the apparatus is turned upside down on a bed and then lifted off the child; the patient is replaced in the reverse manner, and not by lifting him into the box. Children should be kept in this apparatus for two or three years. The whole apparatus, with mattresses, costs from 15*s.* to 20*s.*

Fractured patella.—If the surgeon in charge is in the habit of wiring recent fractures of the patella, he should be summoned without delay. Otherwise, in treating the ordinary transverse fracture of the patella, a plaster-of-Paris bandage over cotton-wadding forms the simplest and most effective apparatus. If the case is seen immediately after the accident, the plaster may be applied at once; but if effusion of blood and synovia has already taken place into the knee-joint, this must be aspirated with a large needle, and the plaster bandage be then applied. If the fluid is not withdrawn by the aspirator, it is important not to put on any apparatus too soon. The knee-joint must have been injured to a certain extent, and will require rest, cold lotions, &c., for some days before the swelling subsides. The portions of bone should be approximated as closely as possible, and all the muscles of the limb relaxed, by making the patient sit up in bed, and by raising the whole limb to a convenient height on pillows or a leg-rest.

When all inflammatory action in the joint is past, if the patient is kept in bed, a simple splint at the back of the knee, with two straps of plaster to hold the fragments together, will answer very well; or Wood's splint may be employed, which is merely a back-splint with hooks put into it, to give fixed points for the bandage to act from, and so to drag the parts together. A broader splint than the common ones will be the best for this purpose, since thus all pressure on the sides of the knee-joint will be avoided; and it is well to bandage the thigh carefully, from above downwards, so as to counteract the action of the extensor muscles (fig. 156).

Traction upon the fragments by means of plaster and a weight may be employed. The limb being secured to a back-splint, crescentic pieces of plaster are fitted above and below the patella, and for some distance on the limb, and are secured by bandages carried round the splint. A cord is then attached to a loop in one horn of the lower crescent, and, being passed through a loop in the corresponding horn of the upper crescent, is brought down to meet its fellow of the opposite side in a double pulley projecting from the foot-piece, so that the weight attached to the cords may hang beyond the bed. The traction would necessarily draw the two fragments together. The same result would be gained by employing the pulley attached to the bed (fig. 145) without the use of a splint.

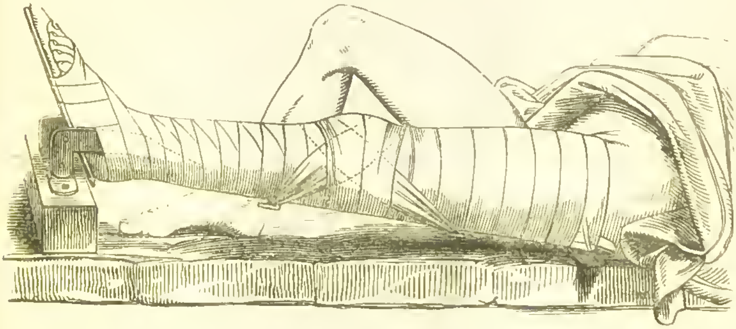

Fig. 156.

Mr. Teale, of Leeds, finds that equally good results are obtained with sand-bags only as with complicated apparatus, and recommends that the patient should be simply confined to bed for six or eight weeks, and when allowed to get up should be fitted with a soft leather splint, which will limit but not arrest the movements of the joint.

Plaster-of-Paris, if not employed from the first, is particularly applicable to the treatment of this fracture when all active mischief has disappeared, and may be applied alone or in conjunction with a light wooden splint at the back of the knee. This method has the great advantage of enabling cases to be treated as out-patients much earlier than would otherwise be possible.

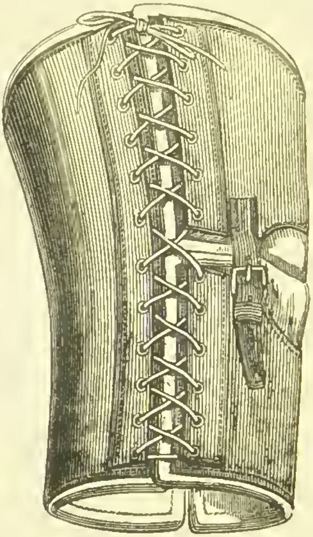

FIG. 157.

The joint must be kept fixed for many weeks; for if flexion be permitted, the tissue uniting the fragments will become stretched and will permanently weaken the limb. When the plaster bandage is removed, a leather splint (fig. 157), made to lace up the sides, may be conveniently worn for some months. It has the advantage of yielding slightly in course of time as the straps are lengthened, and thus of permitting restricted movement of the knee. This leather splint will be found of great service also in cases of rupture of the extensor muscles of the thigh.

Fractured tibia may be treated, from the first, most satisfactorily with the plaster-of-Paris, the starch, or the silicate bandage.

MacIntyre's iron splint is a good but rather cumbersome method of treatment, and, unless care be taken to have the splint no broader than the limb, it is apt to shift to one side as the patient moves in bed. The splint should be slightly flexed at the knee (by means of a screw beneath); and the foot-piece made of a suitable length, and placed at a right angle to the leg-piece. It is usual to fasten to the splint a piece of bandage, which is intended to go beneath the heel; but this will generally be unnecessary if the foot is properly secured to the foot-piece, and it is rather apt to rub the patient's skin (fig. 158).

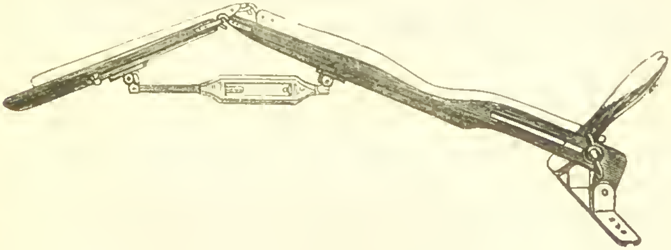

Fig. 158.

A turn or two of bandage having been made around the ankle in order to fix the roller, and the foot having then been secured to the splint, some cotton-wool should be inserted between the malleoli and the side of the splint, to prevent any rubbing at those points;

and the fracture being in proper position—the best criterion of which is that the great toe is in a line with the inner border of the patella—the bandage can be carried round the splint and as far up the leg as may be deemed necessary. Another roller around the thigh and upper part of the splint will complete the arrangement, which can be rendered infinitely more comfortable to the patient by slinging the whole limb either to an ordinary cradle or in a Salter's swing, which allows of more extended movement on the patient's part, and gives great facilities for dressing compound fractures &c. (fig. 159).

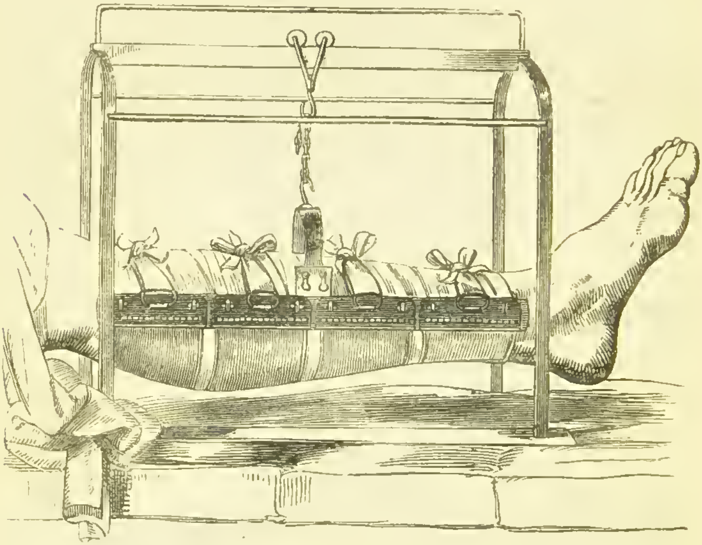

Fig. 159.

A practical point of importance is, that whenever a fractured tibia shows a tendency to 'ride,' the cure is to be found in thoroughly raising the foot. However firmly a limb may be fixed to a splint, it 'gives' a little to the weight of the limb, and suspension by the foot will generally get over the difficulty.

In setting a fractured tibia, care should be taken that the foot is exactly at right angles to the leg, and that the inner border of the great toe is in a line with the inner border of the patella.

In many hospitals *three splints* are employed for all fractures of the tibia, the back one being a straight splint reaching to the ham, with a foot-piece at right angles, and the side splints having foot-pieces also to pass on each side of the limb In applying it, the foot is secured to the foot-piece in the ordinary way with a bandage, which is only carried up to the ankle, and another, or, better, a strip of plaster, is used to confine the limb to the splint above, being applied immediately below the knee. A broad piece of gutta-percha enveloping the limb and the margins of the splint may be substituted for the upper bandage. A pad should be placed beneath the tendo Achillis in order to obviate injurious pressure on the heel. The side splints are best attached by linen straps and buckles, so that they can be readily taken off if necessary (as in dressing a compound fracture), and the whole limb can be swung in the manner recommended above. The whole arrangement is shown in the accompanying illustration (fig. 160), from a sketch of an actual patient.

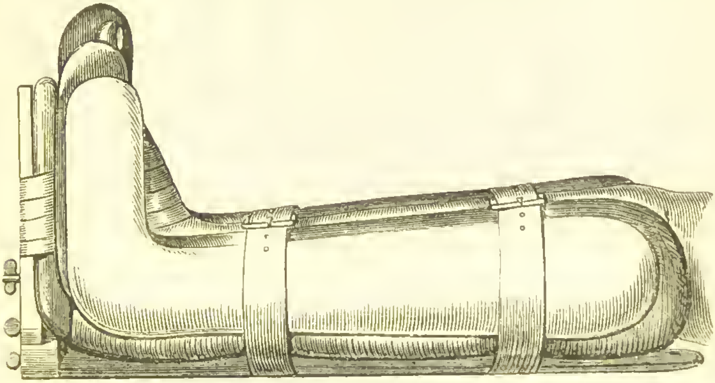

FIG. 160.

Arnold's splint and cradle (fig. 161) is a very useful apparatus for both simple and compound fractures. In it the limb is fixed upon a narrow iron back-splint, which can be slung from the cradle with straps. Side-splints of straight pieces of lath, or, better, Cline's splints, with foot-pieces, as in fig. 160, can be attached by straps, so as to be easily removed in order to dress a wound. The back splint is now made so that it can be altered in length to suit different patients better.

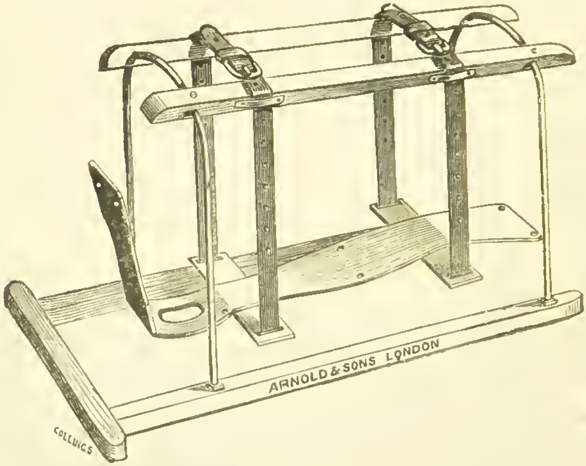

Fig. 161.

Side-splints, commonly known as Cline's (fig. 162), the foot-pieces of which ought to be at right angles to the leg, may be used alone for fractures of the tibia, and the limb may be kept straight and in a swing, or be semi-flexed and laid upon its outer side. The latter method is the ordinary treatment for simple fractures of the tibia in some hospitals, and the flexed position is found to relax the muscles very efficiently, and to permit of proper coaptation of the broken ends more readily than any other plan of treatment. A bandage is not necessary in this method, the splints being sufficiently secured with straps and buckles, and the limb being laid upon a pillow with the knee bent.

Side-splints are sometimes made with the toe-piece on one side cut off; but there seems to be no rule as to which side of the foot the truncated splint should properly go upon, and it will generally be found more convenient to have the two splints of the same shape. There is sometimes a difficulty in reducing a fractured tibia owing to the contraction of the muscles of the calf, and this may be obviated by flexing the knee-joint as in the case of dislocation of the ankle (*q. v.*), or by subcutaneous division of the tendo Achillis.

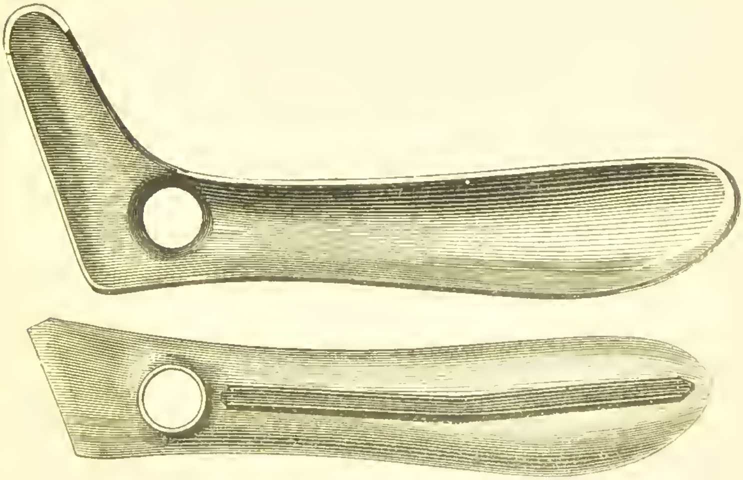

Fig. 162.

Fractured fibula.—If the fracture is at the upper part, where the displacement will be slight, the plaster-of-Paris or starch bandage will answer every purpose; or the limb may be put up in side-splints with the leg extended.

When the fibula is broken towards the lower end (Pott's fracture), with or without dislocation of the foot and fracture of the inner malleolus, reduction must be effected as in a dislocation (p. 343), when it may be most conveniently treated with Cline's splints until the swelling is gone down and plaster-of-Paris can be applied, or Croft's splints may be employed from the first.

Dupuytren's short splint may be used, and in applying it two or three cautions are necessary. In the first place, it is to be applied on the *tibial* side, so as to draw the foot in that direction, with the view of throwing the broken ends of the fibula outwards. Secondly, the efficacy of the splint depends in a great degree upon the pad, which is to be made very thick opposite the point of injury, but thin in the other parts—only sufficient, in fact, to protect the limb from pressure. The foot is first to be bandaged firmly to the lower end of the splint, the notches in which will allow of considerable traction being used; and the bandage is to embrace the malleolus, but not to go more than an inch above it. The thick pad being now carefully inserted between the limb and the splint, immediately opposite the point of injury, another roller is to bind the top of the splint firmly to the tibia, immediately below the knee, but is on no account to be prolonged to the point of fracture.

Some surgeons prefer to apply the upper bandage first, as giving more purchase in bringing the foot straight. The drawback to this method is the uncomfortable strain kept up upon the foot.

Fractures of the foot are generally the results of a severe crush, and need no special mention here. The os calcis is occasionally broken across by falls upon the heel, and the treatment is the same as that for ruptured tendo Achillis (p. 61).

After-treatment of fractures.—The treatment of cases of fracture after they leave the wards devolves generally upon the house-surgeon, who should see that the retentive apparatus is worn long enough to perfect the union of the fracture, but not so long as to interfere with the use of the limb. A weakly united or ununited fracture should be brought under the notice of the surgeon at once, and so also any case in which great loss of power in the limb exists. In the case of fractures near joints, it is important that the splints should be removed from time to time during the treatment, so as to admit of passive movement of the joint. If, at the same time, gentle massage of the limb be effected without displacing the fracture, the result will be more satisfactory than if strict confinement be maintained for the whole period. This applies particularly to fractures of the upper extremity.

The stiffness of the joints above and below the fracture, due to the wearing of splints and bandages for some weeks, is to be treated by friction with oil and passive movements systematically carried out by the patient or his friends. When, however, a joint is firmly locked by adhesions within or without the articulation, the patient should be put under chloroform, and forcible flexion and extension be made. If this is not done, the patient may probably drift into the hands of a ‘bone-setter,’ who will certainly tell him that some bone is ‘out,’ and by forcible manipulation will produce a cracking, taken by the ignorant to show the reduction of a neglected dislocation.

CHAPTER XI

DISLOCATIONS.

The dislocations which ordinarily come under the house-surgeon's care are those of the upper extremity, those of the lower being of very much less frequent occurrence, and for that reason, as well as for their greater severity, being usually referred to the visiting-surgeon.

The existence of a dislocation will be evidenced by the deformity produced in the joint, the ordinary shape of which will be materially altered, while the extremity of the displaced bone will form an unusual projection in the neighbourhood of the articulation. The limb will have assumed an unusual position, in which it will be fixed unless the dislocation should happen to be complicated with a fracture of the shaft of the bone, in which case there will be an abnormal amount of motion in the lower part of the limb, while the upper part will remain fixed and distorted. In recent dislocations there will be no sensation of crepitus ; but in old cases there may be a spurious form of it present, resulting from effusion in the neighbourhood of the joint. Dislocations may be simple or compound, and may be conjoined with fractures either of the articulation or of the shaft. Compound dislocations, being accidents of great severity, in which the question of immediate operative interference will be involved, should be referred without delay to the visiting surgeon. In cases of dislocation with fracture of the *shaft* of a bone, the fracture should be set at once and put up firmly in splints and the dislocation be immediately reduced ; but dislocations with *fracture of the articulation* must frequently be left in their abnormal positions. (*Vide* p. 258.)

Simple dislocations can be reduced, for the most part, by manipulation or by extension, without the administration of chloroform, though that agent must always be resorted to at once if any difficulty should be encountered from muscular resistance. If it becomes necessary to resort to the pulleys, care should be taken to have a good fixed point to which they may be attached, and to protect the limb from injury during their action by the application of a wet bandage.

The *clove-hitch* is the knot ordinarily employed to obtain a firm hold of the limb, and may be made of stout bandage, or, what is better, a stout skein of worsted, which not only takes a better grasp of the limb, but is less likely to inflict damage upon it than a bandage or rope. To make a clove-hitch the operator grasps the worsted with his left hand and forms a simple loop in it with his right, as shown in fig. 163, where a cord is employed for the sake of

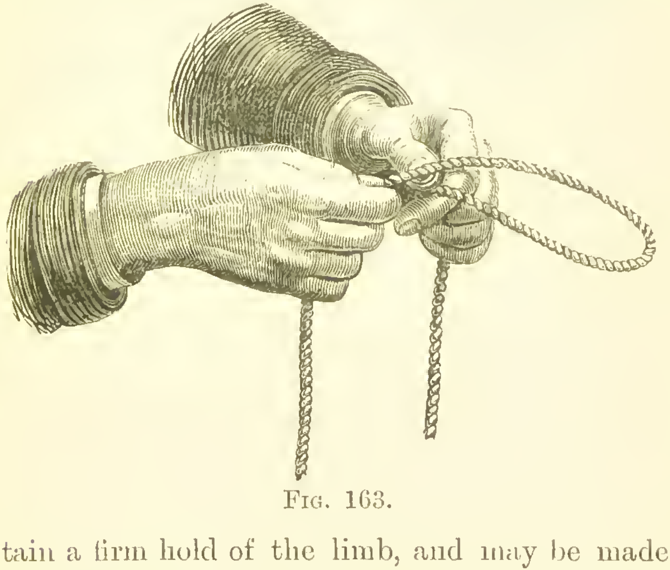

Fig. 163.

greater distinctness. Holding the first loop with the left thumb, he then makes another similar loop, and grasps it with his right hand; and, finally, by passing the one last made beneath the first, completes the clove-hitch (fig. 164). The hitch is easily slipped over the limb to the required point, which should be protected by a few turns of a wet bandage around it, and the hook of the pulleys can then be attached to the other end of the worsted loop.

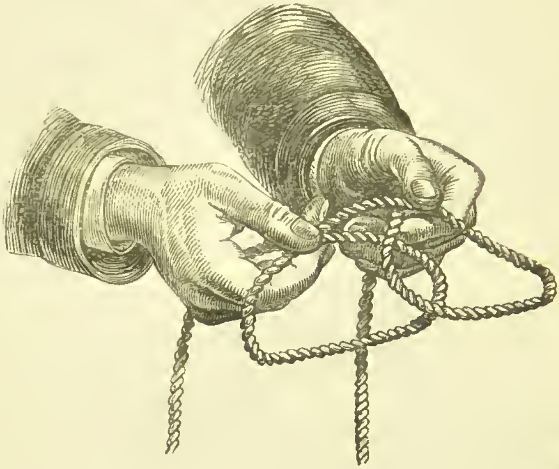

FIG. 164.

There is some difference of opinion as to the point on which traction should be made, most surgeons preferring the extremity of the dislocated bone, while a few attach the pulleys to the extremity of the limb in order to gain additional leverage. It will be found, however, in most cases, best to apply the clove-hitch on the end of the dislocated bone itself, since by that means all possibility of injuring the intervening joints is avoided.

Dislocated jaw (indicated by the widely gaping mouth if the dislocation is double, or by the chin being thrown to the opposite side if one condyle is displaced) is readily reduced by passing the thumbs, protected by a towel, along the molar teeth to the angle of the jaw and then forcibly depressing that portion of the bone, when the jaw will be immediately drawn into its proper position by the contraction of the muscles of mastication.

Dislocation of the acromial end of the clavicle is not very uncommon, and is readily enough reduced by drawing the patient's shoulders back, while the thumb is pushed against the bone so as to thrust it into its proper position. The difficulty always is to retain the bone in its proper place, and this may be attempted by placing a pad over the point, and bandaging firmly through the axilla and round the chest ; but all treatment generally proves futile.

Dislocation of the humerus, as ordinarily met with, *i.e.* beneath the coracoid process or into the axilla, can be reduced most readily by manipulation, either by fixing the scapula with the left hand placed on the shoulder and drawing up the arm over the head with the right hand, or by Kocher's method, as follows :—The elbow, being flexed, is to be firmly pressed against the side of the chest, and while held in contact with the body, the arm is to be slowly and steadily rotated outwards by grasping the forearm, until firm resistance is encountered or the head slips into its place. Failing thus to effect reduction, the surgeon, while maintaining the rotation, brings the elbow forward and across the chest, and, lastly, rotates inwards so as to bring the hand on to the opposite shoulder, with reduction of the dislocation.

Failing to reduce the dislocation by manipulation, recourse may be had to extension with either knee or foot. The patient being seated, the house-surgeon, standing by the side and placing one foot upon the chair, brings his knee into the axilla, and bends the arm forcibly over it. Should this fail to effect reduction, or if the dislocation is on the dorsum scapulæ, recourse should be had to the use of the foot, by which method great force can be exerted. The patient being laid on a flat couch or table, the house-surgeon *takes off his boot*, and having laid a folded towel next the skin, places his heel (right or left, according to the side dislocated) in the axilla ; then, having grasped the arm with his hands, makes forcible but steady traction until the bone flies into its place. Should a fair trial of this method fail in reducing the dislocation, gas or chloroform should be administered and the manipulations be repeated, probably with success. In old cases the pulleys may be had recourse to, the scapula being fixed by a jack-towel passed through the axilla and fastened to some convenient point, and the pulleys being attached to the lower end of the humerus by a clove-hitch over a wet bandage.

After reduction, the arm should be bandaged to the side for a few days, or the accident will very probably recur.

Diagnosis of injuries about the shoulder.—Injuries in the neighbourhood of the shoulder-joint are often of a complex character and doubtful nature, so that their correct diagnosis will tax the powers of the house-surgeon to the utmost—more particularly if, as frequently happens, swelling has come on before he sees the case. A large proportion of the cases which come before the house-surgeon are simply examples of bruise from falls or blows upon the shoulder, and are best treated by resting the arm in a sling, and the use of an evaporating lotion in the early, and a liniment in the later stages. These cases, however, are often troublesome from their tediousness, the patient being unable for a long time to raise his arm thoroughly, owing to partial paralysis of the deltoid muscle, the result of the blow. Under these circumstances, the deltoid wastes and the shoulder becomes flattened, the appearances resembling in some degree, and upon superficial observation, those of a dislocation. Stimulating liniments and galvanism may do good, but the best plan is to make the patient exercise the arm, either by pulling upon a rope with a weight attached to it, passed over a pulley above his head ; or, more simply, by working at the handle of a common pump in company with another person. The effect of either plan is to assist the weakened muscle in raising the arm, and so to exercise it until it fully recovers itself.

In examining cases of injury of the shoulder-joint, it is particularly important to observe the amount of power over the limb possessed by the patient, since in both fracture and dislocation voluntary movement is lost to a great degree ; whilst in simple bruising the patient can cross the arm over the chest or back, although it may give him pain, and although he may be unable to raise the arm to the head.

In the following table the symptoms of the three forms of injury about the shoulder which may be most readily confounded are given,[1] and will serve as guides in the diagnosis of these accidents. It must be borne in mind, however, that the first and second are much more likely to be met with than the third.

SIGNS OF A DISLOCATION.	SIGNS OF A FRACTURE THROUGH THE SURGICAL NECK.	SIGNS OF A FRACTURE OF THE NECK OF THE SCAPULA.
(*Cause, generally a fall upon the elbow or hand.*)	(*Cause, direct blows.*)	(*Cause, generally a direct blow.*)
1. Preternatural immobility.	1. Preternatural mobility often, but not constantly, present.	1. Preternatural mobility.
2. Absence of crepitus.	2. Crepitus, produced easily when there is no impaction, or when the displacement is not complete, and *vice versâ*.	2. Crepitus, generally detected by placing the finger on the coracoid process, and the opposite hand upon the back of the scapula, while the head of the humerus is pushed outwards and rotated.

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[1] Tabulated from Hamilton on *Fractures and Dislocations.*

3. When the bone is brought to its place, it will remain without the employment of force.	3. When once the fragments have been displaced, it is exceedingly difficult ever afterwards to maintain them in place.	3. When reduced, it will not remain in place.
4. Inability to place the hand upon the opposite shoulder (or to have it placed there by an assistant), while the elbow touches the breast.	4. If the fragments remain in place, the hand can be easily placed upon the opposite shoulder. When they completely overlap it is difficult.	4. The hand may generally, but with difficulty, be placed upon the opposite shoulder.
5. Depression under the acromion process; always greatest underneath the outer extremity, but more or less in front or behind according to the dislocation.	5. A slight depression not immediately beneath the acromion, but an inch or more below.	5. Depression under the acromion process, but not so marked as in dislocation.
6. Round, smooth head of the bone felt in its new situation, and moving with the shaft. Absence of the head from the socket.	6. Head of the bone in the socket, and moving with the shaft when impacted, but not otherwise. The irregular upper end of the lower fragment often to be felt pressing upwards to the coracoid process.	6. Head of the bone may be felt in the axilla, but less distinctly than in dislocation. Head of bone moves with the shaft. Head of the bone not to be felt under the acromion process, although it has not left its socket.
7. Elbow carried outwards as a rule, and not easily pressed to the side of the body.	7. Elbow hanging against the side when the fragments are not displaced, but away from the side when displacement exists.	7. Elbow carried a little outwards, but not so much as in dislocation. Easily brought against the side of the body.
8. Arm slightly shortened in the dislocation forwards, and lengthened when in the axilla.	8. Length of arm unchanged, unless the fragments are impacted or overlap. If the fragments are completely displaced, the arm is shortened.	8. Arm lengthened.
9. In taking the vertical circumference of the shoulder in which a recent dislocation exists, by means of a tape carried over the acromion and through the axilla, an increase of about two inches over the sound side will be found.		9. The coracoid process carried a little towards the sternum and downwards.
		10. Pressing upon the coracoid process, it is found to be movable, and to obey the motions of the arm.

Dislocation at the elbow.— Notwithstanding all the minute directions laid down for the diagnosis and treatment of injuries about the elbow-joint, the house-surgeon will find that he can efficiently treat the great majority of cases by flexing the forearm forcibly upon the upper arm. This can be most conveniently done by placing the knee in the bend of the elbow, the foot being on a chair, and bending the arm around it until the dislocation is reduced, when the forearm can be fully flexed upon the humerus. Should the use of the knee not give sufficient power for the purpose, the foot of the operator may be employed, the patient being seated on the ground, and the operator on a chair in front of him.

It is possible that fracture of the humerus immediately above the condyles or separation of the epiphysis may be confounded with dislocation backwards; but the diagnosis will be readily made by noticing that in a fracture the condyles move with the radius and ulna, their relative distances being undisturbed, and that the distortion is immediately reproduced, after apparent reduction, when the traction ceases. Should the rapid swelling which usually attends injuries about the elbow render the diagnosis doubtful, it will be better to refer it to the higher authorities rather than to damage unwittingly a very important articulation. In doubtful cases a skiagraph should be taken if possible.

Dislocation at the wrist is of rare occurrence, and can be readily reduced by flexion and extension. It is liable to be confounded in young persons with a more common accident—viz. separation of the epiphysis of the radius—the diagnosis depending upon the fact that in the latter case the styloid process can be felt to move with the carpus.

Injury of the forearm in young children.—Mr. Duncan M'Nab, of Epping, was good enough in 1862 to call the author's attention to a peculiar injury occurring in young children, caused apparently by their being dragged forcibly by the hand. The symptoms are pain and inability to supinate the hand, which is strongly pronated; the arm is semi-flexed, and the deformity suddenly disappears with a snap upon the hand being steadily supinated by the surgeon, or frequently whilst he is simply examining the case. Mr. M'Nab regarded the injury as a dislocation of the lower end of the radius from the ulna.

M. Goyrand described the same injury to the Surgical Society of Paris in 1861, and maintained that it consisted in a displacement of the inter-articular fibro-cartilage of the wrist in front of the carpal extremity of the ulna. Other French surgeons, however, have believed that the dislocation is at the upper extremity of the radius, and in this Dr. Hedges, of Boston, agrees. The author has met with several cases since his attention was called to the subject, and in some of these the injury, so far as could be judged, was at the wrist, whilst in others it was near the elbow.

The treatment is to grasp and supinate the hand steadily, when the parts will resume their natural position.

Mr. Jonathan Hutchinson, jun., has recently investigated this accident experimentally on the dead subject, and finds that it consists in a slipping of the head of the radius out of the orbicular ligament. Mr. Hutchinson maintains that *pronation* is the most successful method of reduction.

Dislocations of the phalanges may be reduced by flexion and pressure with the fingers in a suitable direction, and it will be generally necessary to employ the clove-hitch, made of a piece of tape, to get a sufficient grasp on the bone, or forceps fitted with leather finger-holders, as shown in fig. 165. The subcutaneous division of the lateral ligaments is but rarely required, and if undertaken, the operator should do as little damage to the articulation as possible.

A simple contrivance (fig. 166), invented by R. J. Levis, an American surgeon, will give a firmer hold upon a dislocated phalanx than the clove-hitch. It consists of a thin strip of hard wood about ten inches in length and one inch or rather more in width. One end is perforated with six or eight holes, and the opposite end is cut away so as to form a projecting handle with a shoulder on each side of it. A piece of strong tape a yard long is passed through the holes nearest the end of the splint, leaving a loop on one side, and a similar piece through another pair of holes. With these the dislocated finger or thumb can be firmly attached to the splint, by drawing the tapes tight and twisting them in opposite directions around

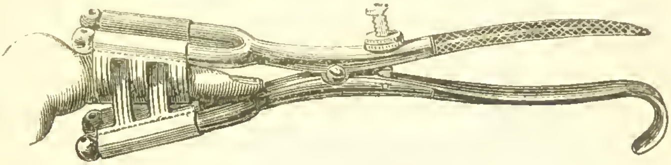

Fig. 165.

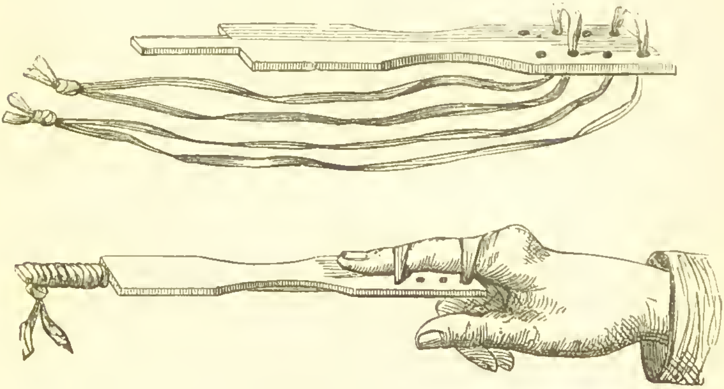

Fig. 166.

the handle, to which they should be securely fastened (fig. 166). The once popular toy 'the Siamese link' is a revival of a puzzle made by the American Indians, and employed many years back by American surgeons in reducing dislocated fingers. This tube is admirably adapted for this purpose, as it takes an exceedingly firm hold upon the finger without exercising injurious pressure upon it.

Dislocations of the femur.—The diagnosis and treatment of these dislocations are entered into so fully in all the ordinary works on surgery, that it will be sufficient to indicate here simply the direction in which force should be exerted in order to reduce the bone by manipulation or extension.

In all cases treated by manipulation, the patient should be laid upon a mattress on the floor, and not on a table. In the two forms in which the limb is *inverted*—viz. dislocation on the dorsum ilii and into the sciatic notch—the thigh is to be flexed and lifted up by the knee, and then steadily *everted* or rolled outwards, and brought parallel to its fellow. In the two forms in which the limb is *everted*—viz. dislocation on the pubes and into the thyroid foramen—the thigh is to be flexed and *inverted*, and then brought down into its natural position.

In applying extension, the following are the rules applicable to the forms the house-surgeon is likely to meet with—viz. in dislocation on the dorsum ilii or into the sciatic notch. In either case the operator may place his foot in the groin and draw the limb downwards and inwards, rotating outwards slightly towards the last, the patient being on his back if the dislocation is upwards on to the dorsum ilii, or on his sound side if the dislocation is backwards into the sciatic notch. If the pulleys are used, the pelvis must be fixed by a jack-towel passed through the groin, and the extending force applied in the direction indicated above.

As soon as reduction is effected the patient's thighs should be fastened together and kept so for some days, to prevent any movement in the joint.

Dislocation of the knee is sufficiently obvious, and is readily reduced ; but its after-consequences may be serious, from injury to the joint or to the popliteal vessels. When reduction is effected, the limb should be placed immediately upon a back splint to insure perfect rest, and every means should be taken to prevent inflammatory action in the joint. Attention should be paid to the existence of pulsation in the arteries of the leg and foot, and to any symptom of injury in the popliteal region, since if rupture of the vessels has taken place amputation will probably be requisite. Compound dislocations of the knee-joint will very probably require immediate operative interference, either amputation or resection of the articular surfaces being necessary in severe cases.

Dislocations at the ankle-joint, with or without fracture of the malleoli, can usually be readily reduced if the leg is flexed upon the thigh so as to relax the muscles of the calf, the contraction of which

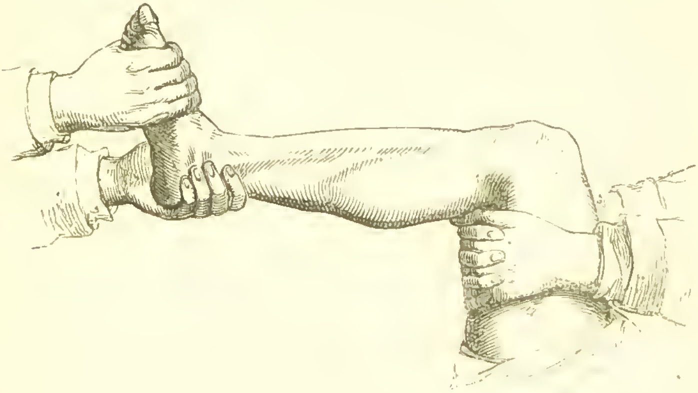

FIG. 167.

forms the chief obstacle to their reduction. This may be easily accomplished by making an assistant clasp the lower part of the thigh firmly and hold it perpendicularly to the recumbent body, when the operator

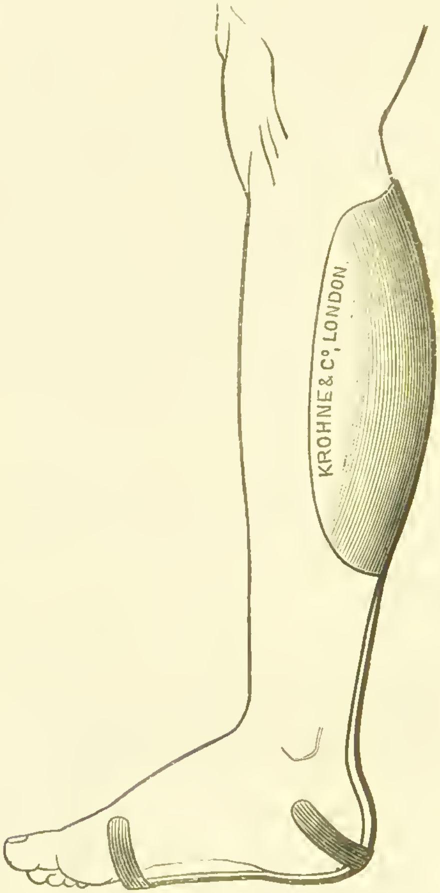
KROHNE & C°, LONDON.

Fig. 168.

can readily flex the leg to a right angle with the thigh, and will be able to exercise the necessary traction (fig. 167). The counter-extending band should be applied in the same manner if the pulleys are employed. When reduction has been effected, the limb should be immediately put up with side-splints having foot-pieces, so as to prevent all motion in the part.

Compound dislocation at the ankle is an accident always involving the question of primary amputation. If it is determined to save the limb, it may be put in a MacIntyre splint ; or, supposing, as is frequently the case, the injury to the skin to be on the tibial side, the knees may be flexed and the limb laid upon its outer side and fastened to an appropriate splint.

The splint shown in fig. 168 is an adaptation of the principle of Thomas's splints to the ankle-joint, and has the advantage of keeping the foot rigid without interfering with the surfaces of the joints.

TREATMENT AFTER EXCISION OF JOINTS

Since cases of excision of joints are always of great interest, the surgeon will naturally give special directions for the treatment of each case according to the particular views he may entertain ; and the following are therefore only general hints upon the subject, which may perhaps be of service to the house-surgeon. In the cases of excision where a movable joint is hoped for, it is of course of no moment that the parts should be kept at perfect rest ; but where the firm anchylosis of the articulation is looked for, as in the knee, it is of the utmost importance that every precaution should be taken to enable the patient to keep perfectly still. With this view it will be advisable in most cases to place the patient, from the first, on a water-cushion, in order to prevent the constant movement of the body, which is otherwise unavoidable.

Shoulder.—A pillow covered with waterproof material, for the arm to lie on, is all that will be required at first (fig. 133). Subsequently, when the patient is able to sit up, the arm must be well supported in a sling.

Elbow.—Surgeons differ very much as to the position in which they place the limb after the operation of excision of the elbow, the rectangular, semi-flexed, and straight positions being employed in different hospitals. A more or less rectangular splint for the fore and upper arm will be necessary for the two former positions, and a straight inside splint, or none at all, is employed for the latter, which in the author's experience gives by far the best results as regards subsequent movement, since the cut ends of the bones are not necessarily brought into close contact.

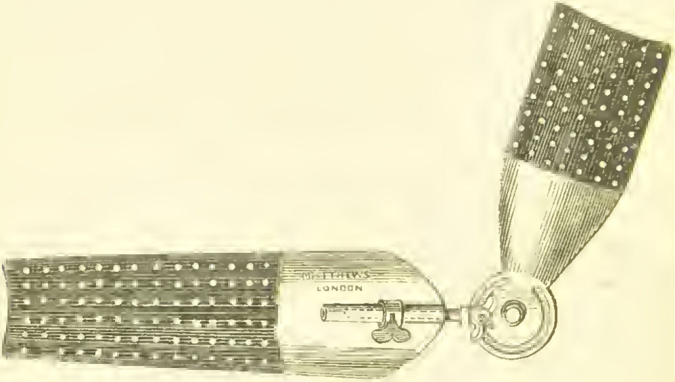

Fig. 169.

Mr. F. Mason contrived a very good splint for cases of excision of the elbow, which has the great advantage of permitting the movements of pronation and supination during the process of healing. It is shown in fig. 169, and being firmly applied to the inner side of either arm, the necessary separation between the cut ends of the bones can be maintained, and the forearm can be flexed and rotated by relaxing the fly-screws.

The wrist may be conveniently treated upon a well-padded splint, on which the hand and forearm may be laid in the prone position (fig. 75).

Hip. This excision can be treated with a long splint, interrupted opposite the joint, and bracketed with a light bar of iron. The splint should reach from the foot to the axilla and be firmly fastened to the trunk, tension being made by means of a rack-and-pinion movement in the splint itself, or by extension from a fillet on the opposite thigh. The distorted position of the limb sometimes renders it difficult to apply any splint properly; and these cases may be most conveniently treated by making extension with a weight over the end of the bed. The weight is to be fastened to the limb by means of a strip of plaster carried up each side above the knee, leaving a loop beneath the foot to which a cord carrying a weight can be affixed (p. 311). This can either hang over the end of the bed or be carried over any simple form of pulley. If the foot of the bed be raised upon a couple of blocks of wood, the patient will be effectually prevented from being drawn down by the weight; or if there is much distortion of the spine, this can at the same time be to a great degree

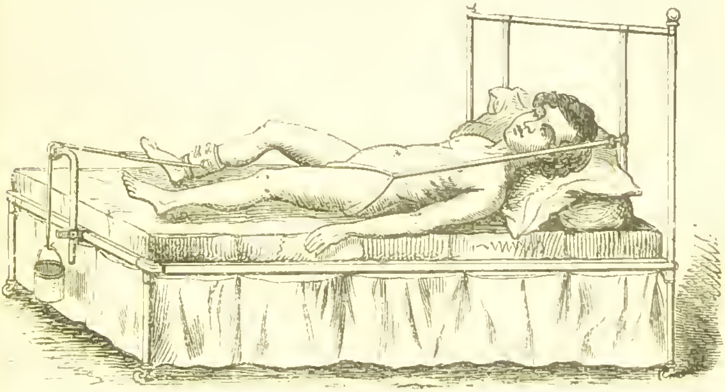

FIG. 170.

remedied by using a counter-extending perineal band passed through the *opposite* groin and fastened to the head of the bed, as seen in fig. 170, where the weight is attached by means of a padded socket and the pulley is shown affixed to the foot of the bed.

By the addition of another pulley, as in fig. 145, the tendency of this contrivance to draw the limb up from the bed can be readily overcome.

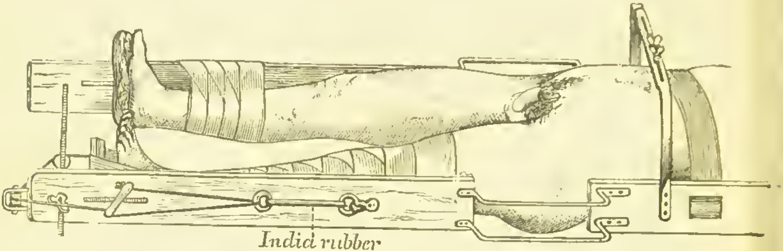

Fig. 171.

Bryant's double thigh-splint, interrupted opposite the thigh-joint (fig. 171), maintains extension by means of an india-rubber accumulator, and may be used for hip-disease or fracture of the thigh. In applying it, the foot-piece on the affected side must be unscrewed and firmly bandaged to the foot before it is attached to the accumulator, which is maintained in action by a tent-rope arrangement similar to that described at p. 314.

Fig. 172 shows an arrangement contrived for a case of excision of the head of the femur, where the patient was at death's door from the irritation caused by his lying on the wound, which had been carried far back on the buttock, but who made a perfect recovery as soon as he was placed in the 'hammock swing.' The contrivance was used in the treatment of several cases subsequently, and has met with some favour among German surgeons, who have also employed the swing in cases of bed sore with advantage ;

but where the wound is made well at the side of the limb, it is not essential. When excision of the hip is done by an anterior incision a double Thomas's splint is all that is required.

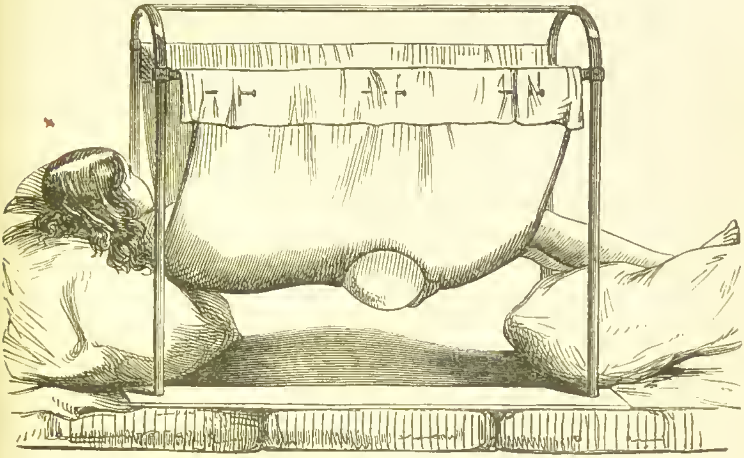

FIG. 172.

Knee.—A Thomas's knee-splint, or a simple straight splint reaching from the foot to the back of the thigh, with a foot-piece, is all that is necessary for the treatment of this excision. A side-splint with a perineal band has been added to this by some surgeons, with the view of steadying the limb to a greater degree, but it is not at all essential (fig. 173). The splint should be carefully padded throughout, and near the

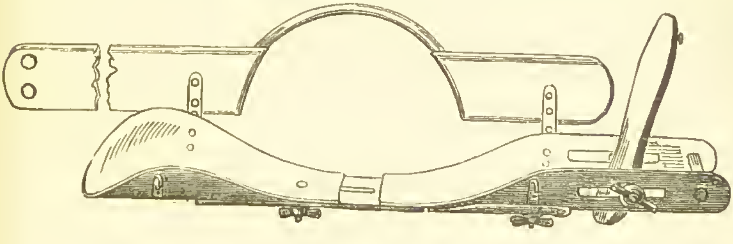

FIG. 173.

joint the pads should be covered with some waterproof material, to prevent the discharges from soaking into pads, which it will be impossible to change for some weeks. The practice of swinging the limb in a Salter's cradle has its advantages and disadvantages, the former being the ease it affords the patient in moving in bed without disturbing the joint, and the latter the tendency there is to produce rotation of the limb and eversion of the knee.

Dr. Heron Watson, of Edinburgh, has successfully employed a wooden back-splint, with a stout wire carried down the front of the leg and arched over the knee, and furnished with hooks for suspension to a cradle. The limb is placed on the splint, and the wire being adjusted, the whole is enveloped in plaster-of-Paris at the time of the operation, the wound only being left uncovered. This insures fixity of the bones and has yielded good results.

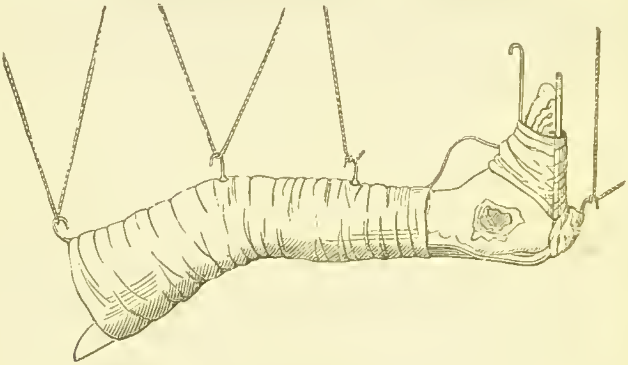

Fig. 174.

Howse's splint for excision of the knee is a metal splint roughly resembling MacIntyre's splint, but the thigh and leg pieces do not reach so near to the knee, and instead of the hinge behind the joint there is a rigid metal bar about two inches wide; at the distal extremity of the splint there is a pulley which revolves transversely; the limb is suspended from this pulley, which allows rotation of the limb when the patient shifts his position, and so protects the knee from jarring. The limb is fixed to the splint by waxed bandages, and the intervals between the knee and the splint are packed with cotton-wool soaked in melted wax and paraffin, which prevents the discharges trickling between the limb and the splint.

Ankle.—A simple back-splint and foot-piece is all that will be required after this excision, and will leave the wound at the sides of the limb perfectly free for the exit of the discharge. A method of suspension, similar to that employed by Dr. Watson for the knee, is shown in fig. 174, and has been found serviceable both after injury and resection of the ankle-joint.

CHAPTER XII

ON CASE-TAKING.

THE careful and systematic reporting of cases is a most important part of a student's duty, and the practice thus acquired will be found of the greatest service to the surgeon in after-life. Moreover, in the present day, it is to the house-surgeons and ward-clerks of the various hospitals that we look for the reports of cases of interest which have occurred in their several institutions, and the publication of which is of the greatest moment for the advancement of medical science. In the following chapter an attempt will be made to suggest the general mode of reporting a *surgical* case, and to draw attention to the principal points which should be recorded, and the order in which it will be advisable to take them. It must be understood that the subsequent observations are only intended to apply to surgical cases; medical cases, being of a more occult and complicated character, require a more extended method of proceeding and a different order in recording.[1]

The great point in recording surgical cases is, to give *all* the facts bearing upon the injury or disease under consideration, but to omit all others which, however interesting in themselves, have no relation to the particular case. Different reporters will bestow a greater or lesser degree of polish upon a case according to their command of language and powers of composition; but if the above cardinal rule be attended to, every scientific requirement will be complied with, and the annoyance of having an imperfect or over-written case will be avoided.

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[1] See also the Introduction to the author's *Student's Guide to Surgical Diagnosis.*

The following particulars must invariably be noted :—

1. Christian name and surname.

2. Age, condition (single or married), and occupation.

3. Late residence of patient (in case of inquiry after the patient has gone home).

4. Date of admission (day of month and year ; or hour, if a case of accident or urgency).

5. Ward, and number of bed.

6. Name of surgeon under whose care the patient is admitted.

7. *The most palpable outward symptom* of the disorder for which the patient was admitted should then be noted in the plainest terms—thus, 'broken leg,' 'tumour of the thigh,' 'severe burn,' &c. &c.

In order to arrive at a clear understanding of the nature of the case, whether it be one of disease or accident, it will now be necessary to inquire into (8) *the history of the case* so far as the patient can give it. This will be extracted with ease from some patients, whilst others will wander into all kinds of irrelevant details, and can only be kept to the point by the most rigid cross-examination. It is in collecting these details that the case-taker's intelligence will be chiefly exercised ; but if he will bear in mind the rule stated above, his duty will be much facilitated. Thus, in cases of accident, the nature of the accident and its immediate results to the patient should be briefly described (*e.g.* a cab-horse knocked the patient down, and the fore-wheel went over the right leg) ; also any medical attendance which the patient may have received before admission should be noted. It is to be borne in mind that all dates of cases should be recorded as days of the *month*, and not of the *week*, or the report will be unintelligible in a short time.

This naturally leads up to (9) *the patient's condition on admission*, which must be ascertained from the officer who saw the case at first; and the physical condition of the patient should always be recorded—thus, 'faint from loss of blood,' 'insensible,' 'sober,' 'drunk,' &c.

These last particulars (9) will only be necessary in cases of accident, since in chronic cases the condition of the patient when seen by the case-taker will vary but little from that on admission.

10. *The patient's previous history* must next be ascertained, so far as it bears upon the probable result of the case or the treatment. Thus it will be important to record whether the patient is habitually sober or given to drink; whether a woman is some months advanced in pregnancy; or whether the thigh of the opposite side was fractured some years ago and has been shortened since that date. Again, in cases of disease—*e.g.* tumour—the family history will have a direct bearing upon the question of malignancy, and so also the previous existence of other tumours, the amount of pain experienced, &c. It will be well to ascertain whether the patient has resided habitually in town or country, and whether he has been engaged at any time in occupations of an injurious tendency. It will be advisable also in many cases, and particularly in the case of children, to obtain further information from the parents or friends when they come to visit at the hospital.

11. *Description of case.* This gives a wide field for the case-taker's ability to show itself, for nothing is more difficult than to give a good verbal description of morbid appearances.

In the simpler cases a few lines will suffice, thus: 'There is a simple transverse fracture through the right humerus immediately below the insertion of the deltoid, with a small effusion of blood into the surrounding tissues, and a bruise on the outer side of the arm over the seat of fracture. No other injury.'

More complicated cases of disease or injury will require more elaboration, and the reporter should endeavour to elucidate all those points which will assist the surgeon in making his diagnosis. Thus, in the case of a tumour of the breast : 'In the lower part of the left breast a tumour of the size of a large orange is developed. The surface of it is smooth, and the skin can be made to glide over it, *the nipple being quite normal.* The tumour is freely movable on the subjacent tissues, and its boundaries can be distinctly made out. At one point in the lower part of the tumour an obscure sense of fluctuation is perceived. There is a little pain present occasionally in the tumour, but it is only of a dull aching character. There is no enlargement of the axillary or cervical glands, nor any other tumour in any part of the body.'

In all cases of surgical disease, the condition of the thoracic, abdominal, and genito-urinary organs should be investigated, and the fact that they have been examined and found normal or otherwise should invariably be noted. The general appearance of the patient (full-bodied, cachectic, &c.) should be noted, and whether he presents any indication of a scrofulous or tubercular diathesis.

If the case-taker can give a little drawing of the appearances of the disease, though only a pen-and-ink sketch, it will add much to the value of the report.

In all urinary cases the condition of the urine as to (1) quantity, (2) reaction, (3) specific gravity, (4) albumen, (5) urea should be recorded. The estimation of urea may be most readily made with Gerard's ureometer (fig. 175), the operation being completed in less than five minutes. The determinations are scientifically accurate, no calculations being needed, as the result of the analysis is read at once in percentages of urea.

Method of using.—Pour into the tube 5 c.c. of the urine to be examined, and in the bottle (*a*) 25 c.c. or 6 fluid drachms of sodium hypobromite solution. Place the tube carefully inside the bottle, as shown in the illustration, avoiding spilling any of the contents. Fill the glass tubes (*b c*) with water, so that the level reaches the zero line, taking care that when this is done the tube (*c*) contains only a little water by being placed high—it having to receive what is displaced from (*c*) by the nitrogen evolved. Now connect the india-rubber tubing to the bottle, and noting lastly that the water is exactly at zero, upset the contents of the tube into the hypobromite solution. Nitrogen is evolved, and depresses the water in (*b*). When this ceases, lower (*c*) until the levels of

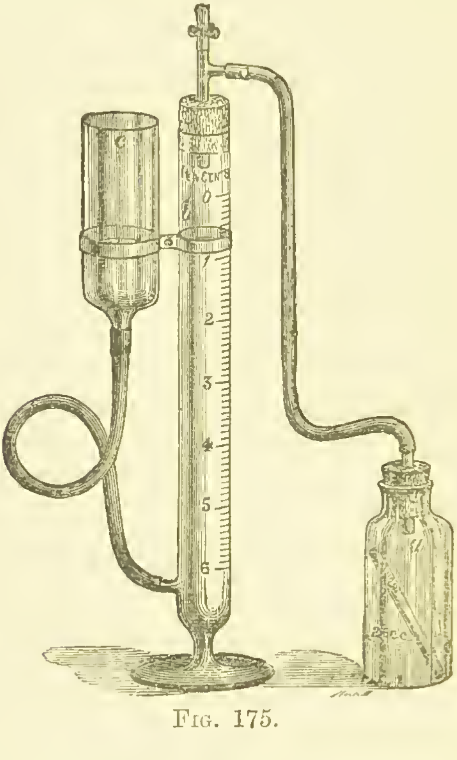

FIG. 175.

the water in both tubes are equal. To be exact, dip (*a*) into cold water to cool the gas before taking a reading, and note the result, which shows the percentage of urea.

The solution of hypobromite of soda is made by dissolving 100 grammes of caustic soda in 250 c.c. of water, then adding 22 c.c. of bromine.

To avoid the danger of the bromine vapour, the bromide is sold in hermetically sealed glass tubes, containing 2·2 c.c. ; one of these placed in the large bottle with 25 c.c. of the soda solution gives, when broken with a sharp shake, the exact quantity of hypobromite for one estimation of urea, and all bad odour is avoided.

12. *Diagnosis and remarks of surgeon.*—These must be carefully reported, and the best way is to enter them roughly in a note-book at the time, and write them out carefully afterwards. A few lines will generally suffice, provided the case has been properly taken beforehand, but some surgeons have a weakness for dictating the whole case over again in their own words.

13. *Treatment.*—The treatment, both local and general, must be carefully noted ; and in the case of fractures &c. the apparatus used should be distinctly named (long splint, MacIntyre, &c.), or if of unusual form, it should be fully described, and its inventor's name mentioned. The diet ordered must be recorded, and all prescriptions carefully copied, with the several ingredients under one another, and not in one line. When the form of book will allow of it, it is well to enter the prescriptions in the margin.

14. *Progress.*—In acute or urgent cases, the daily or even hourly condition of the patient should be reported ; but in chronic cases a report twice or three times a week is ample.

In all acute cases, particularly when any operation has been performed, a tabular record of the pulse, respiration, and temperature should be kept for the inspection of the visiting-surgeon. These should be recorded twice a day, at the same hour morning and evening, and will be found of great service in guiding the treatment. Clinical thermometers are now entrusted to the nurses, who should report to the house-surgeon twice daily. The 'register' thermometer—*i.e.* a thermometer in which a small portion of mercury, separated by a bubble of air, serves as an index—is in ordinary use. Before using the thermometer it is necessary that the register should be set, and this is readily accomplished by holding the instrument firmly between the finger and thumb of one hand, and giving it a slight jerk by striking one arm against the other. The detached portion of mercury is thus shaken down to the column in the instrument, and will indicate any rise in its level.

The thermometer is most conveniently placed in the mouth of the patient, and should be left *in situ* for five minutes in order to get the correct temperature. The normal temperature of the human body is 98·4° F., and any great rise above this is indicative of severe constitutional disturbance. The occurrence of a rigor, as in pyæmia, is usually preceded by a sudden and extreme rise in temperature. The records of temperature may be kept either in columns or in a tabular form, by which latter the variations are more readily appreciated, and of which the accompanying is a convenient specimen (see p. 361).

It is most important to record any new symptom at the time of its occurrence, since thereby the absurdity of noting the cessation of a symptom which has never been mentioned before is avoided. Also, precise terms should be used, and such vague statements as 'Is better to-day' be avoided.

Any remarks which the surgeon may make during the progress of the case should be recorded, and particularly any reasons he may assign for change of treatment, or for proposing operative interference.

15. *Operation.*—The steps of an operation should be most carefully described; thus, the fact of anæsthetics being administered or otherwise; the incision made (length and direction), and the instrument it was made with; the use of saw, bone-forceps, or other instrument; the amount of hæmorrhage (arterial or venous), and the method employed to arrest it; any unexpected occurrences during the operation; the dressings applied; and the condition of the patient when removed to bed. Any remarks upon the case which the surgeon may make in the operating-theatre should be taken note of; but it will not be necessary, of course, to recapitulate the history of the case, of which he will probably give a sketch to the spectators.

In the case of tumours, limbs removed for disease, &c., a minute account of the appearances of the diseased portions, as seen after removal, should be appended.

The history of the case must, of course, be resumed after an operation, and especial care taken to notice the state of the pulse and respiration; whether sickness is present or not; the administration of stimulants or anodynes, &c. The condition of the wound must be minutely described, whether there is oozing of blood, and if so, to what extent; whether suppuration is set up or the parts heal by first intention, and the nature of the dressings which are applied. Daily reports are essential for at least the first week or ten days after a severe operation; subsequently, longer intervals are allowable, but all important epochs should be recorded—*e.g.* the first dressing, the removal of stitches, the first time the patient leaves his bed, and the date of the final closing of the wound.

16. *Result.*—This must invariably be recorded. If favourable, mention should be made of the general condition of the patient at the time of his discharge, and more particularly of the results of the treatment to which he has been subjected. The date both of month and year must be carefully recorded, and also whether the patient is discharged to a convalescent institution or to his own home.

In the case of death, the date and hour of death must be recorded, and also, if possible, the mode of death. The record of the post-mortem examination should be appended to the case, and the condition not only of the part affected, but of all the organs of the body, should be investigated, since the information thus collected may have an unexpected importance at some future time.

When a case is concluded, the name of the disease and the result should be placed at the top of it, for the sake of easy reference, and the clerk should sign his name at the end. In long cases, which are carried on to a page at a little distance, double references should be given—'Continued at p. —,' and 'Continued from p. —.'

A case-book should be provided with a double index: in one the names should be in the first column, in alphabetical order, for reference while the patient is in the house; but the second index should consist of several parallel columns, in which the following should be entered: 1. Disease (referred to each organ—thus, Urethra, stricture of; Breast, scirrhus of, &c.). 2. Name. 3. Age. 4. Date of admission. 5. Date of discharge, or death. 6. Operation. 7. Result. The number of the page may be placed before or after the other particulars, as most convenient.

NAME. AGE. DISEASE. RESULT.

MONTH. DAY.																														Remarks.
FAHRENHEIT'S SCALE.	106°	M.	E.	M.	E.	M.	E.	M.	E.	M.	E.	M.	E.	M.	E.	M.	E.	M.	E.	M.	E.	M.	E.	M.	E.	M.	E.	M.	E.	
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	96°																													
Pulse.																														
Resp.																														

TABLE FOR

REPORTING A SURGICAL CASE

1. Name.
2. Age and Condition, and Occupation.
3. Address.
4. Date of Admission (day of month and year).
5. Ward and Bed.
6. Surgeon.
7. Injury or Disease.
8. History of Case from Patient.

[9. Condition on Admission.]

10. Patient's previous History.
11. Description of Case.
12. Diagnosis and Remarks of Surgeon.
13. Treatment.
14. Progress.

[15. Operation.]

16. Result.

CHAPTER XIII

POST-MORTEM EXAMINATION

The neat and satisfactory performance of a post-mortem examination should always be aimed at in hospital practice; while in private it is of still greater importance to avoid offending the feelings of relatives by unnecessary noise, or wanton soiling of the clothes, furniture, &c.

The body being stripped and laid upon a table or the lid of the coffin, the house-surgeon should take notice of any external appearances which may be worthy of remark, and in cases of medico-legal investigation these should be at once noted with pen and ink. In the case of surgical operations, also, the appearance of the wound should be investigated before any further steps are taken.

If the head is to be examined it should be taken first, since the appearance of the brain will be materially modified by the cutting of the large vessels of the heart &c.

Examination of the head.—The head being raised to a convenient height upon a block or tripod-stand, the hair should be parted across the top of the skull from ear to ear. An incision down to the bone is then to be carried in the same direction across the top of the head, and never across the forehead. The scalp, being thoroughly divided, can be drawn forward over the brow and backward over the occiput, being freed from the skull, where necessary, with the knife. A line is now to be marked with the knife all around the skull, necessarily cutting through the temporal muscle on each side ; and the mistake is often made of carrying this line much too low, thus materially embarrassing the after-steps. It should pass about an inch and a half above the orbit in front, and half an inch above the occipital protuberance behind, while at the sides the line between these two points should be kept as high in the temporal fossæ as the shape of the head will allow.

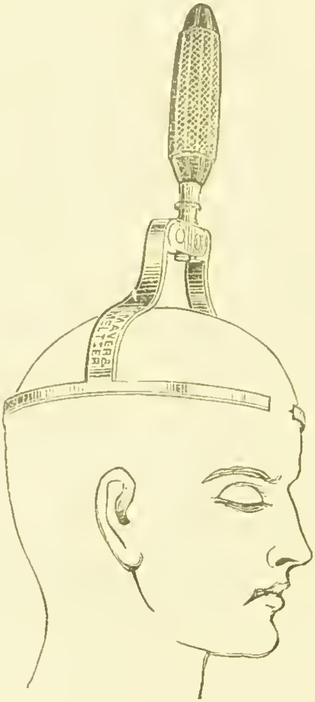

Fig. 176.

In order to saw through the calvaria easily, the saw must be sharp and used lightly, and the head must be held quite steady, and for this purpose may be gripped by one of several contrivances or 'skull-grips,' of which one is shown in fig. 176. The best way is to stand on the left side of the corpse, to grasp the head firmly with the left hand, and place the heel of the saw on the frontal bone. A few firm but light backward and forward movements will soon cut through the outer table of the skull, and the cut can then be readily prolonged backwards. The head must be moved as may be most convenient; and, when approaching the occiput, the operator will either have to stoop considerably to use the saw effectively, or must raise the back of the head to a suitable level. Having finished the left side of the head, the operator may either lean over, if he is tall enough, and continue the sawing on the right side, or, which is much easier, he may come round to the right side, and putting the heel of the saw in the extremity of the former cut, can carry it back to meet the one of the opposite side at the occiput. There are three points where the saw requires to be thoroughly applied—viz. at the occiput, and at the anterior extremities of the temporal ridges on the frontal bone; but care should be taken not to carry the instrument so deeply as to wound the *dura mater* or brain.

In the hospital dead-house, where noise is of no consequence, it is unnecessary to saw through more than the outer plate of the skull, and the inner may be more expeditiously divided with the chisel and mallet; but in private houses the saw must be carried through the entire thickness of the skull, which must be merely 'prised' open with the chisel, to which a handle should be fitted at right angles with the shaft, so as to give a leverage to the operator's hand. When the calvaria is very firmly attached to the dura mater, it may be either dragged off forcibly with the hook provided for the purpose, or a steel sound or staff (of which there is usually one in a post-mortem room) may be introduced between the two, and be made to tear through the adhesions. When the adhesions are especially firm, the shortest way of overcoming the difficulty is to divide the dura mater all round in the line of the incision, and remove skull-cap and dura mater together. In cases where any injury to the skull is suspected during life, and generally in cases the subject of medico-legal investigation, great care should be taken to divide the calvaria altogether with the saw, lest a difficulty should arise in determining whether a fracture of the skull is not the result of the violent efforts to remove the skull-cap. (A good plan in such cases, suggested by Mr. Hutchinson, is to cut off the upper convolutions of the brain and their membranes with the skull-cap, and to remove them subsequently for its examination.) The superficial parts of the membranes having been examined, they should next be opened in the following way:—The knife is carried round the cut edge of the skull and made to divide the dura mater, which can then be lifted up on each side so as to expose the *falx*; this, being divided with the knife from its attachment to the ethmoid bone, can be drawn backwards, and the upper surface of the brain will be fully exposed. (If it be necessary to examine the sinuses of the skull, the superior longitudinal should be laid open before the *falx* is detached.)

To remove the brain.—Lift up the anterior lobes with the left hand, turning up with them the first pair of nerves. Next divide the optic nerves (second), which will be seen close to the *clinoid processes*, and immediately behind them the internal carotid arteries, with the *infundibulum* in the middle line. The third pair will next be seen, and then the *tentorium cerebelli*, which is to be divided on each side by carrying the knife along the posterior margin of the petrous bone; this cut will divide the fourth nerves, and the fifth will be at once exposed, when the sixth, seventh, eighth, and ninth nerves will follow in their natural sequence. Lastly, the knife is passed through the *foramen magnum* to divide the *medulla oblongata* and vertebral arteries, and the brain can then be lifted out.

The brain having been weighed, the base and the arteries should be first investigated; and it may then be carefully sliced from above downwards, in order to examine the several parts of the organ.

The sinuses of the base of the skull may now be readily examined, by carrying the knife along their several situations.

To open the orbit.—This is best done from above, after the removal of the brain. The saw should be carried through the remainder of the frontal bone, at the inner and outer angles of the orbit, and these cuts can then be prolonged backward through the roof of the cavity with the chisel. The triangular piece of bone thus marked out can then be tilted forward, and the contents of the orbit will be exposed. If it is merely required to examine the eyeball, this can be more readily removed from the front, in the same way as during life, with a pair of scissors.

To remove the temporal bones.—This may be required in cases of deafness, or occasionally in fractures. The brain having been removed, the knife should be carried down outside the bone, so as to separate the auricles with the skin, which should be drawn down. The saw is then to be carried behind the mastoid process to the jugular foramen, and through the squamous portion up to the basilar process; a little force with the chisel, and a division of any soft parts with the knife, will then lift the bone from its place. The knife is next to be carried beneath the bone, to free it from its attachments to the lower jaw and pharynx, care being taken, however, to leave the Eustachian tube attached to the under surface.

To remove the spinal cord.—The body being turned on its face over a block, so that the dorsal region may be well elevated and curved, an incision is to be carried from the occiput to the lower part of the lumbar region. All the muscular tissue is to be turned aside as far as possible with the skin, so that the vertebral arches may be fully exposed. With the saw a cut is then to be made on each side of the dorsal region, close to the articular processes, but sloping inwards towards the vertebral canal, and with the chisel these three or four arches can then be removed. A strong spine-chisel or rachet is next to be used, and the hook being inserted in the canal, it can be hammered through the arches for the whole length of the spine, and with a pair of bone-forceps they can readily be removed in a few minutes ; the dura mater will then be seen, and must be divided to expose the cord. To remove the cord, the knife must be carried outside the dura mater, to cut through the nerves on each side and the *cauda equina* below, when the cord can be readily lifted out, and sliced in various parts, as may be necessary.

Chest and abdomen.—These cavities are generally laid open together by an incision from the root of the neck to the pubes. This cut, begun over the lower part of the trachea, should be carried along the centre of the sternum down to the bone, then only through the skin to the umbilicus, in a semicircle around that point, and so on to the pubes. Returning to the lower extremity of the sternum, the operator should then carefully deepen the incision, so as to open the cavity of the peritoneum for an inch or two ; this being done, the first and second fingers of the left hand can be introduced, and will serve to hold up the abdominal wall, while the knife is passed between them, with its back to the intestines, and made to cut through the whole thickness of the muscles at once down to the pubes. The skin and pectoral muscles are then to be dissected off the sternum and cartilages of the ribs, which should be fully exposed.

Thorax.—The knife is now to be carried through the sterno-clavicular articulation on each side, which will be readily accomplished by placing the point close to the inner end of the clavicle and cutting downwards and outwards. The cartilages of all the ribs are next to be divided, and it must be borne in mind that the cartilage of the first rib will be found a little farther from the middle line than either the sterno-clavicular articulation or the cartilage of the second rib. All the cartilages should be divided as near their respective ribs as practicable, and should be cut evenly on the two sides. In old subjects the cartilages of the ribs, and particularly the first one, are more or less calcified, and will require the application of the bone-forceps. The lower part of the sternum is now to be lifted up, and the attachment of the diaphragm divided ; after which, by the division of a little cellular tissue, the sternum will be quite freed, and may be lifted off. If, as is generally the case, the pleuræ are very adherent to the sternum, they will be removed in part with that bone, and the lungs will be fully exposed. These are to be drawn forward and examined superficially, notice being taken of the amount of fluid in the pleural sacs. The pericardium is next opened by a vertical incision, and the heart exposed. (Any fluid in the pericardium, if its measurement is required, should be withdrawn with a syringe.)

The heart and lungs are best removed together, by cutting through the trachea, drawing it down with the left hand while dissecting it away from the œsophagus, then cutting across the great vessels at the root of the neck, and so dragging the whole contents of the cavity out together. The heart will be found to be attached to the diaphragm by the remains of the pericardium and by the vena cava ; but these can be readily divided, and the organs removed for further examination.

The lungs are to be carefully sliced from above downwards, and the bronchi can be readily laid open, if necessary, by carrying a pair of scissors along the back of the trachea, and so into the bifurcation.

The Heart may be either examined as it is, or separated by dividing the pulmonary vessels and the arch of the aorta, when the interior can be readily exposed. The cavities are best laid open in their natural order, *i.e.* following the course of the blood.

The *right auricle* is opened by an incision from one *vena cava* to the other, and a second at right angles to it into the auricular appendage.

To open the *right ventricle*, pass the forefinger through the auriculo-ventricular opening into the cavity, then push the knife through the anterior wall, well to the right of the septum, and, guided by the finger, transfix the ventricle, and cut downwards so as to make a sort of triangular flap. The finger, introduced into this opening, will then guide the knife towards the auriculo-ventricular aperture; and the tricuspid valve should first be examined from below, and then the auriculo-ventricular ring being cut through it will be fully exposed. The finger will next guide the knife into the pulmonary artery, which is to be laid open, care being taken to pass the knife *between* the semilunar valves. The clots generally found in the right side of the heart should be removed, and the cavities washed out, so that they may be thoroughly examined before the left side is opened.

The *left auricle* will be exposed by a vertical cut through the posterior wall, passing between the pulmonary veins of the two sides.

The *left ventricle* should be transfixed with the knife to the left of the septum, and opened in the same way as the right; and the mitral valve, having been examined from below, will be fully exposed by dividing the auriculo-ventricular ring. The finger should be passed into the aorta, to direct the knife between the valves, and the vessel may then be laid open, the knife necessarily passing through and destroying the pulmonary artery and valves.

The dissection of thoracic tumours, aneurisms, &c., will vary according to circumstances ; but it will be always found much more satisfactory to dissect the tumour *in situ*, than to remove it *en masse* and attempt to examine it afterwards.

To examine the larynx.—An incision is to be made from the chin to the sternum, and the skin carefully dissected back for some distance. The knife is then to be pushed through the floor of the mouth, and made to detach it on each side from the jaw. The tongue can next be drawn down through the aperture thus made, and the knife made to divide the pillars of the fauces, and go well back to the vertebræ, so as to divide the pharynx. The tongue, larynx, and pharynx can then be drawn down together, and either separated from the lungs or removed with them. The cavity of the larynx is best exposed from behind.

Abdomen.—The contents of this cavity having been fully exposed (p. 368), they should be first examined *in situ*, and then removed.

The *Stomach* is removed, with its contents, by tying the œsophagus and dividing it above the ligature, then placing two ligatures at the pylorus, two inches apart, and dividing between them. The contents should be carefully set aside in any case of medico-legal inquiry, and the viscus laid open by carrying a pair of scissors along the lesser curvature.

The *Intestines*, large and small, are to be removed together by placing a couple of ligatures at the commencement of the *jejunum* and of the *rectum*, and dividing the intestine at these points. The large intestine should be separated from its attachments in its whole length, and turned over to the right side; then turning the small intestines in the same direction, and grasping the mesentery with the left hand, one sweep of the knife will free them from their attachment. The small intestines will be most readily prepared for examination by cutting off the mesentery with a pair of scissors, and they must always be *opened* on the side to which the mesentery was attached.

The *Pancreas, duodenum, and spleen* will be fully exposed by the above proceeding, and can be examined *in situ*, or readily removed if desirable.

The *Liver* is most easily removed by taking with it a piece of diaphragm—that is, if the thorax has been opened; if not, the ligaments must be divided, and the organ dissected away from the diaphragm. The *vena cava* will, of course, require to be divided both at the diaphragm and also below the liver; and any dissection within the abdomen should be finished before this is done, or it will be spoiled by the blood which pours out.

The *Kidneys* can be extracted without interfering with the intestines, by turning them over to the opposite side, dividing the peritoneum in the lumbar region, and drawing forward the gland. The vessels and ureter must be divided to allow of its removal, and its interior is to be exposed by an incision along the convex border.

The *Bladder and rectum, uterus and ovaries*, can be removed by dividing all the structures lying upon the floor of the pelvis close to the levator ani, and drawing them out of the cavity, severing at the same time the connections at the sides. If it is desirable, however, to remove the bladder with the urethra, the following dissection must be made.

To remove the urethra and bladder.—The most satisfactory way is to remove also a portion of the pubes. The abdomen having been opened by the usual incision, it should be prolonged on the upper surface of the penis for a short distance, and the skin be separated from the body of that organ as far as the glans, where the penis may be divided ; unless it is desired to remove the whole of the organ, in which case the foreskin must be cut, and reflected from it. An incision carried round the root of the penis, and through the scrotum to the anus, will allow the skin with the testes to be reflected from off the front of the pubes. The saw should make a vertical cut through the bone, about an inch on each side of the symphysis, and the bladder having been separated from its attachments in the pelvis and to the rectum, a few touches of the knife will isolate the part, so that the bladder, urethra, and penis can be removed in one piece. The symphysis may be afterwards divided, and the urethra and bladder be laid open from above, or otherwise as may be most convenient.

No special directions can be given for the post-mortem examination of injuries, tumours, &c., a knowledge of anatomy and of the use of the scalpel being all that is required for their due performance.

In all cases of post-mortem examination care should be taken to restore the exterior of the corpse to its ordinary appearance. Thus, the head should be weighted to correspond to what it was before the brain was removed ; the scalp should be carefully sewn up, and the hair arranged so as to hide the incision. In order to keep the calvaria in its proper position, and thus prevent a deformity of the forehead, brass pins, half an inch in length, and sharpened at both ends, may be advantageously employed. If one of these is inserted into the diploë at each temple and at the occiput, the calvaria can be pressed down upon them, and fixed in its proper position with a few gentle blows of the hammer.

Another mode of accomplishing the same thing is to drill a hole in each temporal fossa with a gimlet, and corresponding holes in the calvaria, and to twist pieces of copper bell-wire firmly between them with a pair of pliers. The twisted ends are covered in by the temporal muscles, and make no projection on the surface.

The sternum should be replaced, and the abdomen and thorax sewn up from below, the thread being always entered on the under surface of the skin and at regular intervals, and a long strip of plaster may be laid over all. If the rectum or vagina has been divided, its orifice should be sewn up, or fluid will pour out when the body is removed ; and where the front of the pubes has been taken away, a piece of wood should be inserted between the innominate bones, so as to keep them steady. When the glans penis has been left, it will be sufficient to distend the skin behind it with cotton-wool ; but when it has been removed, a piece of liver cut to an appropriate shape, and secured in the foreskin with a stitch, makes a very passable substitute.

The neck should be stuffed with tow or cotton-wool when the larynx has been removed ; and where the eyeball has been extracted, a very good substitute can be made of a knuckle of small intestine, tied with a piece of thread, and inserted between the lids.

After any post-mortem or dissecting work, the house-surgeon should be most careful to cleanse his hands, and, if possible, change his clothes, before entering the wards or touching a patient. The hands should invariably be washed in *cold* water, and well brushed with a hard nail-brush. If then immersed for a minute or two in carbolic acid lotion, or in a very weak solution of chloride of zinc or mercuric chloride and then washed again with carbolic soap, all smell will be effectually removed, and the possibility of any infection being transmitted to the patients considerably lessened. Eau-de-Cologne sprinkled on the hands, and allowed to evaporate, is a most efficient agent for removing any slight remaining scent from them, after having been thus thoroughly washed. The practice of oiling the hands before commencing operations certainly diminishes the amount of absorption of offensive matter, but renders the holding of instruments difficult, and hence increases the liability to accidental cuts or scratches.

India-rubber gloves may be worn with advantage.

In case any injury is received in making a post-mortem examination, it is a safe precaution to wash the hands at once, to suck the wound, and apply a piece of plaster until the operation is completed, when water-dressing is the best application. Any tenderness or redness of the lymphatics of the arm is best treated by the prompt application of the Glycerinum Belladonnæ. It is not generally from evident cuts that the occasional danger arises, but from unseen scratches in a person out of health, which are inoculated with the poison of some specially diseased body.

The record of the post-mortem appearances should be made at the time, and with the parts in view; for unless this plan is adopted, some important point is almost certain to be omitted. The easiest way is for the operator to dictate to a bystander, who can roughly report the particulars, which should be carefully written out immediately afterwards.

TABLE OF AVERAGE WEIGHTS

OF THE

ORGANS OF THE BODY

Tabulated from QUAIN'S '*Anatomy*,' by SCHÄFER and THANE.

	Male.	Female.
Brain	48¼ oz. Avoir.	43¼ oz. Avoir.
Cerebrum	42¼ oz.	37¾ oz.
Cerebellum	5 oz.	4¾ oz.
Pons and medulla oblongata	1 oz.	¾–1 oz.
Spinal Cord	1 oz.	7¾ dr.
Heart	11 oz.	9 oz.
Lungs	right, 24 oz. left, 21 oz.	right, 17 oz. left, 15 oz.
Thyroid	1–1½ oz.	2 oz.
Liver	53 oz.	45 oz.
Pancreas	3 oz.	3 oz.
Spleen	6 oz.	6 oz.
Kidney	4½ oz.	4 oz.
Supra-renal capsule	1 dr.	1 dr.
Prostate	4½–4¾ dr.	...
Testis	¾–1 oz.	...
Uterus (virgin)	...	7 dr.–12 dr.
Ovary	...	1 dr.–1½ dr.

FORMULÆ

The following formulæ have been selected from the pharmacopœias of those metropolitan hospitals which have recently issued a new edition of their special formulæ.

1. Confectio Cubebæ Co. (St. Mary's).
    ℞ Pulv. Cubebæ, ʒiv;
    Balsami Copaibæ, fʒij;
    Theriacæ, fʒij. *Dose*—fʒij.

2. Confectio Sennæ cum Sulphure (St. Mary's).
    ℞ Confect. Sennæ, fʒvj;
    Sulphuris, ʒj. *Dose*—fʒj ad fʒij.

3. Emulsio Iodoformi (University).
    ℞ Iodoform in fine powder, 10 ounces;
    Glycerine, 70 ounces;
    Water, 20 ounces.

Rub the iodoform smooth with a portion of glycerine, add the remaining glycerine and water, and mix well. Shake well before use.

4. Enema Olei Ricini (Westminster).
    ℞ Olei Ricini, fʒij;
    Saponis mollis, ℥j;
    Aquæ calidæ, f℥xx. Misce.

5. Fomentum Papaveris (Westminster).
    ℞ Papaveris Capsularum, ℥j;
    Aquæ, f℥xx.
    Boil for a quarter of an hour, and strain.

6. Gargarisma Acidi Tannici (Consumption).
    ℞ Acidi Tannici, ʒj;
    Glycerini, fʒij;
    Aquam ad f℥v. Misce.

7. **Gargarisma Aluminis** (University).

℞ Aluminis, ʒj;
Mellis, fʒiv;
Aquam ad f℥iv. Misce.

8. **Gargarisma Boracis** (Westminster).

℞ Boracis, ʒj;
Theriacæ, fʒx;
Aquam ad f℥v. Misce.

9. **Gargarisma Hydrarg. Perchlor.** (St. Mary's).

℞ Hydrargyri Perchloridi, gr. iij;
Glycerini, f℥j;
Acidi Hydrochlorici, ♏xij;
Aquam ad f℥xij. Misce.

10. **Gargarisma Potassii Chloratis Acidum** (Consumption).

℞ Potassii Chloratis, gr. l;
Acidi Hydrochlor. dil., ♏l;
Syrupi Rhœados, fʒij;
Aquam ad f℥v. Misce.

11. **Gargarisma Sodii Chlorati** (St. Bartholomew's).

℞ Liquoris Sodii Chlorati, fʒiv;
Aquæ, f℥viij. Misce.

12. **Glycerinum Belladonnæ** (University).

℞ Extracti Belladonnæ, ʒviij;
Aquæ, fʒij;
Glycerinum ad f℥ij.

13. **Guttæ Atropinæ Sulphatis** (Ophthalmic).

℞ Atropinæ Sulphatis, gr. j;
Aquæ destillatæ, f℥j. Misce.

14. **Guttæ Opii** (Ophthalmic).

℞ Vini Opii, fʒij;
Aquam ad f℥j.

15. **Guttæ Zinci Sulphatis et Aluminis** (Ophthalmic).

℞ Zinci Sulphatis, gr. j;
Aluminis, gr. iij;
Aquæ, f℥j. Misce.

16. Haustus Aromaticus (Middlesex).

℞ Pulv. Cretæ Aromatici, gr. xxx ;
Mucilaginis, fʒj ;
Aquam Carui ad f℥j.

17. Haustus Carminativus (Westminster).

℞ Rhei, gr. v ;
Zingiberis, gr. v ;
Sodii Bicarbonatis, gr. x ;
Sp. Ammonii Aromatici, ♏xx ;
Aquam Cinnamomi ad f℥j.

18. Haustus Diaphoreticus (Westminster).

℞ Antimonii Tartarati, gr. $\frac{1}{12}$;
Liq. Ammonii Acetatis, fʒij ;
Aquam ad f℥j.

19. Haustus Diureticus (Westminster).

℞ Potassii Acetatis, gr. xx ;
Sp. Ætheris Nitrosi, fʒss ;
Decoctum Scoparii ad f℥j.

20. Haustus Effervescens (Westminster).

℞ Sodii Bicarbonatis, gr. xx ;
Aquæ, f℥j ;
℞ Acidi Tartarici, gr. xviij ;
Aquæ, f℥j. Misce.

21. Haustus Emeticus (St. Bartholomew's)

℞ Vini Ipecacuanhæ, fʒiv ;
Oxymellis Scillæ, fʒiv ;
Aquam ad f℥jss.

22. Haustus Imperialis (University).

℞ Potassii Tartratis Acidæ, ʒj ;
Sacchari, ʒiv ;
Aquæ bullientis, f℥xx. Misce.

23. Linctus Communis (Charing Cross).

℞ Extracti Opii liquidi, ♏iij ;
Acidi Sulphurici diluti, ♏v ;
Syrupi Scillæ, ♏xv
Theriacæ, fʒss ;
Aquam ad fʒj.

24. LINCTUS SCILLÆ CO. (University).
   ℞ Oxymellis Scillæ, ♏xxiv;
   Tincturæ Camphoræ Co., ♏xij;
   Vini Ipecacuanhæ, ♏vj;
   Mucilaginem Acaciæ ad f℥j.

25. LOTIO ACIDI NITRICI (University).
   ℞ Acidi Nitrici diluti, ♏xv;
   Tinct. Opii, ♏xv;
   Aquæ, f℥j. Misce.

26. LOTIO AMMONII CHLORIDI (EVAPORANS) (St. George's).
   ℞ Ammonii Chloridi, gr. xxx;
   Aceti destillati, fʒj;
   Spiritûs Rectificati, fʒj;
   Aquam ad f℥j. Misce.

27. LOTIO CALAMINÆ (University).
   ℞ Calaminæ levigatæ, gr. xl;
   Zinci Oxidi, gr. xx;
   Glycerini, ♏xx;
   Aquam ad f℥j.

28. LOTIO CALCIS SULPHURATÆ (University).
   ℞ Slaked lime, ℥iv;
   Sulphuris, ℥iv;
   Aquæ, f℥xxxv.
   Boil and evaporate to one pint (for scabies).

29. LOTIO HYDRARG. PERCHLOR. HYDROCYANICA (St. Bartholomew's).
   ℞ Hydrargyri Perchloridi, gr. ½;
   Glycerini, fʒij;
   Acidi Hydrocyanici dil., ♏viij;
   Aquam ad f℥j.

30. LOTIO RUBRA (Middlesex).
   ℞ Zinci Sulphatis, gr. x;
   Spiritûs Rosmarini,
   Tincturæ Lavandulæ Compositæ, āā fʒijss;
   Aquæ, f℥x. Misce.

31. LOTIO RUBRA (St. George's).
   ℞ Cupri Sulphatis, ʒss;
   Camphoræ, gr. viij;
   Armenian Bole, ʒss;
   Aquæ ferventis, f℥viij. Misce.

32. Lotio Sodii Hyposulphitis (Charing Cross).

℞ Sodii Hyposulphitis, ʒvj ;
Glycerini, fʒiv ;
Aquam ad f℥x. Misce.
(For parasitic skin affections.)

33. Mistura Acaciæ Opiata (Consumption).

℞ Tinct. Camph. Co., fʒss ;
Sp. Chloroformi, ♏v ;
Mucilaginis Acaciæ, fʒij ;
Aquam ad f℥j.
(For cough.)

34. Mistura Acida Aromatica (King's).

℞ Acidi Hydrochlor. dil., ♏xv ;
Sp. Armoraciæ Co., ♏x ;
Tinct. Zingiberis, ♏v ;
Infusum Calumbæ ad f℥j.
(Aromatic tonic.)

35. Mistura Acidi Gallici (Consumption).

℞ Acidi Gallici, gr. x ;
Tinct. Camphoræ Co., ♏xx ;
Acidi Sulphurici dil., ♏xv ;
Aquam ad f℥j.
(To check sweating.)

36. Mistura Acidi Phosphorici (University).

℞ Acidi Phosphorici dil., ♏xv ;
Sp. Chloroformi, ♏x ;
Infusum Gentianæ Co. ad f℥j.
(Nervine tonic.)

37. Mistura Ætheris Composita (St. George's).

℞ Ætheris Sulph., fʒj ;
Sp. Ammoniæ Aromatici, fʒss ;
Syrupi, fʒss ;
Aquæ Pimentæ, fʒiij ;
Aquam ad f℥j.
(Stimulant.)

38. Mistura Alba (King's).

℞ Magnesii Carb., gr. x ;
Magnesii Sulph., ʒj ;
Aquam Menthæ Pip. ad f℥j.
(Saline purgative)

39. Mistura Ammonii Acetatis (University).

℞ Liq. Ammonii Acetatis, fʒij ;
Potassii Nitratis, gr. x ;
Aquam Camphoræ ad f℥j.
(Anti-febrile.)

40. Mistura Antimonialis Aperiens (University).

℞ Magnesii Sulphatis, ʒij ;
Antimonii Tartarati, gr. $\frac{1}{12}$;
Aquam ad f℥j.
(Lowering aperient.)

41. Mistura Aromatica (St. Mary's).

℞ Sodii Bicarbonatis, gr. x ;
Ammonii Carbonatis, gr. iv ;
Tinct. Cardamomi Co., fʒss ;
Infusum Caryophylli ad f℥j.
(Warm stomachic.)

42. Mistura Aromatica Infantum (Middlesex).

℞ Confectionis Aromaticæ, ℈ij ;
Magnesii Carbonatis, gr. viij ;
Tincturæ Rhei, ♏xl ;
Aquam Menthæ Pip. ad f℥j. Misce.
(Carminative and purgative.) *Dose*—fʒj to fʒij.

43. Mistura Carminativa (St. Thomas's).

℞ Magnesii Carbonatis, gr. xx ;
Pulveris Rhei, gr. x ;
Tinct. Camphoræ Co., ♏xxx ;
Sp. Ammoniæ Aromat., ♏xxx ;
Aquam Anethi ad f℥jss.
(Soothing anti-spasmodic.)

44. Mistura Colchici Aperiens (University).

℞ Tinct. Colchici, ♏xv ;
Magnesii Carbonatis, gr. vj ;
Magnesii Sulphatis, ʒss ;
Aquam Menthæ Piperitæ ad f℥j.
(Purgative in gout.)

45. Mistura Copaibæ (University).

℞ Copaibæ, ♏xxx ;
Liquoris Potassæ, ♏xij ;
Aquam Cinnamomi ad f℥j.
(Stimulant to urinary organs.)

46. Mistura Cretæ Aromaticæ Anodyna (London Ophthalmic).
℞ Pulv. Cinnamomi Co., gr. x;
Pulv. Acaciæ, gr. x;
Cretæ præparatæ, gr. x;
Tincturæ Opii, ♏v;
Aquam ad f℥j.
(Astringent.)

47. Mistura Diaphoretica (London).
℞ Vini Ipecacuanhæ, ♏xv;
Sp. Ætheris Nitrosi, fʒss;
Mist. Salinæ ad f℥j.

48. Mistura Diuretica (St. Mary's).
℞ Potassii Acetatis, gr. xx;
Spiritus Ætheris Nitrosi, fʒss;
Spiritus Juniperi, fʒss;
Mucilaginis, fʒss;
Decoctum Scoparii ad f℥j.

49. Mistura Effervescens (King's).
℞ Sodii Bicarbonatis, gr. xx;
Aquæ, f℥j. Misce.
Capiat dum effervescendum cum sequente.
℞ Acidi Tartarici, gr. xviij;
Aquæ, f℥ss.
(Cooling saline.)

50. Mistura Ferri Aperiens (University).
℞ Magnesii Sulphatis, ʒss;
Ferri Sulphatis, gr. ij;
Acidi Sulphurici dil., ♏x;
Aquam Menthæ Pip. ad f℥j.
(Tonic aperient.)

51. Mistura Gentianæ c. Soda (University).
℞ Sodii Bicarbonatis, gr. xviij;
Infusi Gentianæ Co., f℥j.
(Tonic.)

52. Mistura Ipecuacuanhæ Co. (Consumption)
℞ Vini Ipecacuanhæ, ♏x;
Tinct. Camphoræ Co., fʒss;
Aquam Anethi ad f℥j.
(Sedative and expectorant.)

53. MISTURA IPECACUANHÆ INFANTUM (Middlesex).

℞ Vini Ipecacuanhæ, ♏xl ;
Mucilaginis, fʒiij ;
Syrupi, fʒjss ;
Aquam ad f℥ij.
(Expectorant.) *Dose*—fʒj to fʒij.

54. MISTURA OLEI MORRHUÆ (Consumption).

℞ Olei Morrhuæ, fʒvj ;
Liq. Potassæ, ♏xl ;
Liq. Ammoniæ fort., ♏ij ;
Ol. Cassiæ, ♏j ;
Syrupi, fʒij. Misce.

55. MISTURA RHEI CUM MAGNESIA (University).

℞ Rhei Pulveris, gr. vijss ;
Magnesii Carb., gr. xv ;
Tinct. Zingiberis, fʒss ;
Aquam Menthæ Pip. ad f℥j.
(Mild purgative.) *Dose*—fʒj to fʒij for children.

56. MISTURA SALINA APERIENS (University).

℞ Magnesii Sulphatis, ʒj ;
Magnesii Carbonatis, gr. ix ;
Aquam Menthæ Piperitæ ad f℥j.

57. MISTURA SCILLÆ CO. (St. Mary's).

℞ Oxymellis Scillæ, fʒss ;
Tinct. Camphoræ Co., ♏xv ;
Sp. Ætheris Nitrosi, ♏xv ;
Aquam Camphoræ ad f℥j.
(Expectorant.)

58. MISTURA TARAXACI ACIDA (University).

℞ Succi Taraxaci, fʒj ;
Acidi Nitro-hydrochlor. dil., ♏x ;
Tinct. Calumbæ, ♏xxiv ;
Infusum Calumbæ ad f℥j.
(Cholagogue tonic.)

59. MISTURA TOLUTANA (Consumption).

℞ Tincturæ Tolutani, ♏x ;
Tinct. Camphoræ Co., fʒss ;
Mucilaginis, fʒss ;
Aquam Anisi ad f℥j.
(Soothing expectorant.

60. Pasta Caustica (Middlesex).

℞ Zinci Chloridi, ℥j;
Flour, ʒiij;
Liq. Opii Sedativi, f℥j.
(To be mixed into a paste.)

61. Suppositorium Belladonnæ (University).

℞ Ext. Belladonnæ, gr. ½.
Olei Theobromæ, gr. xv.

62. Suppositorium Morphiæ (University).

℞ Morphiæ Hydrochlor., gr. ½ ad gr. j;
Olei Theobromæ, gr. xv.

63. Suppositorium Opii (Middlesex).

℞ Pulv. Opii, gr. j;
Olei Theobromæ, gr. xv.

64. Unguentum Acidi Boracici (University).

℞ Boracic Acid, 2 parts;
White Wax, 1 part;
Paraffin, 2 parts;
Almond Oil, 4 parts;
Prepared Lard, 3 parts;
(Dissolve and mix.)

DIET TABLES

St. Bartholomew's Hospital

FULL DIET	HALF DIET	BROTH DIET	MILK DIET
2 pints of tea.	2 pints of tea.	2 pints of tea.	2 pints of tea.
14 oz. bread.	12 oz. bread.	12 oz. bread.	12 oz. bread.
½ lb. meat (cooked).	¼ lb. meat (cooked).	1½ pint broth	1½ pint milk, or
½ lb. potatoes.	½ lb. potatoes.	6 oz. potatoes (mashed).	1 pint milk with arrowroot, rice, or sago.
2 pints beer (men).	1 pint beer.	¾ oz. butter.	¾ oz. butter.
1 pint beer (women).	¾ oz. butter.	Gruel.	Gruel.
1 oz. butter.			

Guy's Hospital

FULL DIET	MIDDLE DIET	LOW DIET	MILK DIET
14 oz. bread.	12 oz. bread.	10 oz. bread.	12 oz. bread.
1 oz. butter.	1 oz. butter.	¾ oz. butter.	1 oz. butter.
1 pint porter.	½ pint porter.	½ pint beef-tea.	2 pints milk.
6 oz. meat (cooked), with potatoes.	4 oz. meat (cooked).		½ pint beef-tea.
½ pint broth, occasionally.	½ pint broth, occasionally.		
½ lb. rice pudding, three times a week.	½ lb. rice pudding, thrice weekly.		

Tea and sugar morning and evening with all diets.

St. Mary's Hospital

FULL DIET	ORDINARY DIET	HALF DIET
2 pints tea, with sugar.	2 pints tea, with sugar.	2 pints tea.
½ pint milk.	½ pint milk.	1 pint milk.
15 oz. bread.	12 oz. bread.	12 oz. bread.
6 oz. meat (cooked).	4 oz. meat (cooked).	2 oz. meat (cooked).
½ lb. potatoes.	½ lb. potatoes.	½ lb. potatoes.
¾ oz. butter.	¾ oz. butter.	¾ oz. butter.

University College Hospital

FULL DIET	MIDDLE DIET	SPOON DIET
12 oz. bread.	12 oz. bread.	2 pints milk.
8 oz. potatoes.	8 oz. potatoes.	1 pint beef-tea.
6 oz. meat (cooked).	4 oz. meat, or 8 oz. fish.	12 oz. bread.
¾ pint soup, alternate days.	1 pint milk.	2 oz. arrowroot, and
4 oz. rice pudding.	1 pint soup or beef tea, or 4 oz. rice pudding.	1 oz. sugar made into jelly.
1 pint milk.	½ pint beer.	
1 pint beer.		

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